

CURLEY'S HANDBOOK OF WEIGHTS AND MEASURES FOR THE USE OF SEALERS



SECOND EDITION

W. & L. E. GURLEY
TROY, NEW YORK, U. S. A.
DEPARTMENT

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COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF WEIGHTS AND MEASURES.



Exhibit of the Commonwealth of Massachusetts at Pure Food Show, Boston, Mass., 1907

A
HANDBOOK
FOR THE USE OF
SEALERS OF WEIGHTS
AND MEASURES

FIRST EDITION PREPARED BY
F. REICHMANN, PH. D.

FOR
W. & L. E. GURLEY

Second Edition

W. & L. E. GURLEY
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INFORMATION TO PURCHASERS

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PREFACE TO FIRST EDITION

This handbook outlines methods for accurately and quickly inspecting and testing such weights and measures as come under the sealer's jurisdiction. All unnecessary details, such as the testing of odd or rare apparatus, have been avoided.

It is hoped that the book may stimulate the effort to have weights and measures properly inspected and tested and in producing uniformity in the methods employed.

We here gratefully acknowledge the advice which has been given frequently and freely by the National Bureau of Standards, and by Mr. D. C. V. Palmer, the Commissioner of Weights and Measures of the Commonwealth of Massachusetts, who has also written the introduction which follows.

For convenience, please address all correspondence in relation to weights and measures or Sealer's Apparatus to Department P.

W. & L. E. GURLEY,
TROY, N. Y., U. S. A.

PREFACE TO SECOND EDITION

Since the appearance of the first edition of the "HANDBOOK" the subject of weights and measures has gained considerable importance, people are beginning to realize that full and just quantity is commensurate in importance with honest quality.

The labor of the National Bureau of Standards; the energy of its director, Dr. S. W. Stratton; the untiring interest of Mr. L. A. Fisher, Federal Officer in Charge of Weights and Measures; the establishment of the office of Commissioner of Weights and Measures under the leadership of Commissioner Palmer in the State of Massachusetts; the reviving of the office of Superintendent of Weights and Measures in the State of New York; the legislation on the subject in various States; the conference of State Sealers of Weights and Measures; and the astoundingly beneficial results attained by some of the larger cities, particularly New York and Chicago; all have contributed to this increase of interest in the subject.

Our frontispiece shows an exhibit of Weights and Measures made at the Pure Food Show in Boston in 1907, by the State Department of Weights and Measures of Massachusetts. That in itself shows how intimately connected with daily life the subject is, and we wish to acknowledge our obligation to Commissioner Palmer for allowing us to insert this cut in the "HANDBOOK."

Our factory has enlarged its facilities, added to its fundamental standards and is supplying accurate standards all over the world. Our product is essentially and distinctly of the highest order of workmanship and precision, and not being manufacturers of any kind of trade weights and measures our men are trained only in the highest class of work.

We are pleased at all times to be of whatever assistance we may to sealers or to anyone interested in this subject.

W. & L. E. GURLEY,
TROY, N. Y., U. S. A.

INTRODUCTION

“The science of measuring and weighing holds an important place in the history of civilization. There is scarcely an art more universal or more vitally important. Weights and measures are fundamental necessities of commerce, industry and science.”

In all civilized foreign countries, citizens are protected from unscrupulous dealers by the regular inspection of their weights and measures; and in all cases a decided reduction of necessary confiscations has resulted since the establishment of such inspection.

In Massachusetts, the benefit derived from the service of the sealer may be readily understood from the fact that annually thousands of short milk jars are rejected by the sealers. Unfortunately, many of these jars are shipped by the manufacturers to some adjoining State where no local inspection exists.

It is surprising that the majority of States and cities of the United States are so slow in taking an interest in the welfare of the mass of its citizens by proper attention to this subject. A large percentage of goods sold are short measure, either intentionally or accidentally. It is hoped that the enforcement of existing laws or the passage of new laws will mitigate this evil.

I heartily approve of any honest endeavor to promote this most vital and important subject, and therefore have consented to write this brief introduction.

Signed,

D. C. V. PALMER,
*Commissioner of Weights and Measures of the
Commonwealth of Massachusetts.*

HISTORICAL

Since the existence of society, weights and measures have been used in the exchange and barter of goods. In the earliest times, these took the form of similar pebbles, grains, or vessels. Each tribe had its own rough standards, those of the chief or tribal head being larger than the others when receiving tribute.

Intercourse between tribes and nations having different standards resulted in general confusion. A systematizing and adjusting of the measures was attempted, but the only far-reaching reorganizations have been brought about during the last century. A great deal is yet to be done to bring about international uniformity.

It is not necessary to enter into a discussion of ancient standards, as their values are largely a matter of conjecture. There existed in Greece and Rome, however, a system of inspection which we have every reason to believe was a great deal better than that in many cities and States of the present time.

The middle ages afford nothing of interest on this subject.

The first step of any value was made in 1795, when the French, realizing that their measures were in an extreme state of confusion, devised and adopted an entirely new system. The meter was made the standard of length and all other units were based on this. The whole system was rigidly decimal, and was called the "Metric System." A great deal of thought and accurate work was put upon this new system, and various conferences were held. In 1870, the French Government invited all countries to send representatives to consider the advisability of constructing new standards. A second conference, in 1875, resulted in the establishment of the International Bureau of Weights and Measures. Since that time, many of the nations have adopted the metric system; others have made it permissive; and it will probably soon be universally adopted and made compulsory.

England has attempted to improve its system of weights

and measures by reorganization, rather than by adopting an entirely new system. This change was made in 1824, when the imperial gallon containing ten pounds of water and the bushel containing eight gallons were adopted. A new pound weight was made in 1869, and in 1878 the Troy pound was abolished.

Canada has changed her English system to a decimal one.

The history of the weights and measures of the United States is excellently outlined in the paper by Mr. L. A. Fischer in the proceedings of the "Conference on the Weights and Measures of the United States," published by the Bureau of Standards, Washington, D. C., 1905. The early weights and measures of the United States were of English origin, having been mostly copies brought over by colonists. As the measures of England were not standard, the copies showed wide divergence. According to the Constitution of the United States, Article 1, Section 8, Congress has the power to fix the standards of weights and measures, but, unfortunately, it has rarely exercised this power, leaving the matter largely to the individual States.

In 1828, the Troy pound was adopted for the Philadelphia mint as a standard of coinage. This brass pound was procured by Minister Gallatin and was received by President Adams.

The avoirdupois pound was derived from the Troy pound, to bring about uniformity in the custom houses, large discrepancies having been found in the standards in use in the different ports. The Treasury Department adopted the yard of thirty-six inches, an avoirdupois pound of 7,000 grains, a gallon of 231 cubic inches, and a bushel of 2,150.42 cubic inches. The yard was the distance between two marks on a bar brought from England and supposed to be identical with the English yard. The avoirdupois pound was derived from the mint Troy pound, making it equal to $\frac{7000}{5760}$ of a Troy pound. The gallon was equal to the old English wine gallon (abolished in England in 1824). The bushel was equal to the old English Winchester bushel (abolished in England).

In 1836, Congress passed acts to furnish each State with weights, measures, and balances similar to those made for the custom houses.

In 1856, copies of the new yard and avoirdupois pound were presented to the United States, and the new yard was then accepted as standard by the office of weights and measures.

In 1866, Congress legalized the metric system, giving tables of equivalents, and the Secretary of the Treasury was authorized to furnish each State with metric standards.

In 1890, the United States received copies of the international meter and of the international kilogram, which were distributed by lot to the various governments by the International Bureau of Standards.

In April, 1895, the international meter and kilogram, being far superior in permanency to the previous standards, were made the fundamental standards of length and mass in the United States, both for metric and customary weights and measures. It is important to note that the standards of the United States are different from those of England (in some cases varying as much as seventeen per cent.), and are based directly on the metric standards.

Unfortunately, different States have defined measures in different ways, and, taking the weight of a certain commodity to represent its capacity, these measures vary widely.

DUTIES OF A SEALER

The laws of different cities and States vary in their definitions of the duties of a sealer of weights and measures; the name of his office indicating in a general way the duties to be performed.

The sealer should have the proper authority to enter any establishment, or to stop any person or wagon, and inspect any weights and measures which are used in the sale or barter of merchandise of any form. A badge of office should be worn, which may be shown when necessary.

Every sealer should be prepared to properly inspect, test, and seal any measure, bottle, weight, weighing machine, box, etc., that may be used in the transaction of business, and, consequently, the accuracy and convenience of his standards and apparatus are of utmost importance.

A tour of inspection should be made at regular and irregular intervals, and measures not readily tested on the premises should be sent to the office of the sealer for such testing.

Further, the sealer should be ready to inspect and test measures of any kind upon the proper request of a merchant or upon the complaint of a customer, and also for evidence in court.

All faulty or incorrect measures and all weights and scales that are short or false should be confiscated and destroyed, when they cannot be repaired or adjusted. In this latter case they should be conspicuously tagged "condemned till repaired."

In order that the sealer may be sure of his tests, he should compare at intervals, possibly monthly, his working standards with his office standards, and periodically the State Sealer should inspect the local sealer's outfit and make the necessary alterations or corrections, or have them sent to a responsible manufacturer of sealers' apparatus for repairs, and to the State Department of Weights and Measures or to the National Bureau of Standards for verification.

EQUIPMENT

The equipment of a sealer of weights and measures will vary in different localities, according to the nature of the business or manufacturing interests; and it may be more or less elaborate according to the size of the community and the laws of the locality or State.

There is, however, one imperative condition: *The sealer's standards must be carefully and accurately made, or his tests will be of no value.*

The equipment may be divided in two parts: (1) the Office, and (2) the Apparatus.

OFFICE

A suitable office and storeroom should be provided, the latter being necessary for the preserving of records and the temporary keeping of condemned measures. The suggested floor plan on page 12 shows the least space that a sealer should be content with.

It should have the following furnishings:

A cabinet (No. 9675, see page 86), the upper part of which may be used for a large testing balance (No. 9570), and length and weight standards, for which shelves are provided; the lower part for the keeping of capacity and other standards.

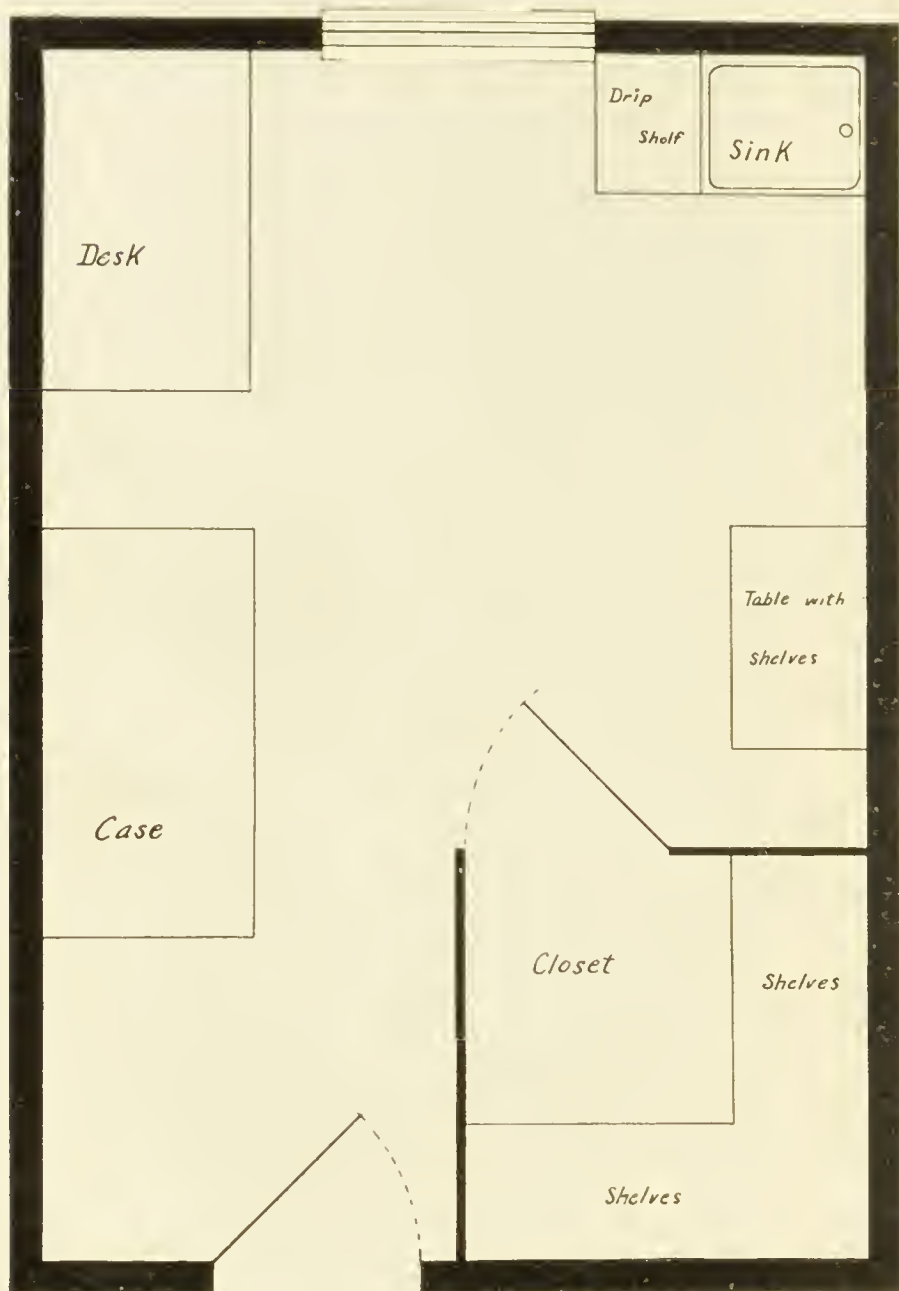
A sink with water connection and a drip shelf, for testing liquid capacity measures. The sink should preferably be of wood, lead lined, and of sufficient depth, about twelve inches, to cover the measures with water.

A box for small grain or beans to be used with the Hopper Funnel (No. 10040), in testing dry measures.

A shelf on the wall for a small balance (No. 9590).

A table with shelves, or a cabinet for tools, etc. (See pages 106, etc.) The table or workbench should be provided with a vise, a sealer's anvil and straightening iron, and a small vertical drill similar to No. 10272.

A desk and necessary chairs.



SEALERS' APPARATUS

As already stated, the standards are the most important part of the sealer's equipment and it cannot be too strongly emphasized that they must be not only carefully constructed but accurately adjusted and easily and conveniently handled. The apparatus should comprise the following:

(a) A large Office Balance for testing and adjusting weights up to fifty pounds or twenty-five kilograms. This should be so constructed that when arrested no knife edge touches its corresponding plane or bearing. It should have beam, hanger, and pan arrestment. The central support should be stable. A balance, where the pans are simply hung from the ends of the beam, will soon become insensitive, due to the blunting of the edges. Figure 9570 shows a balance well suited to accurate work. The planes are of agate, the knife edges of hardened steel, and the beam of aluminum. When the crank is turned to the right, the beam with the knife edges is raised and there is no wear when the balance is not in use. The beam is provided with adjusting screws on each end. A mirror back of the ivory index greatly facilitates readings.

(b) A small Office Balance for calibrating and adjusting small weights, from one-half pound or two hundred grams down. This balance should be provided with agate edges and planes and with a rider for the beam. It should be provided with a glass case having a sliding door. A balance for this purpose is listed and described on page 85.

(c) A Portable Balance of about eight pounds or four kilograms capacity. This should be as compact and light as possible, yet rigid and sensitive and easily set up in any place. The pans should be slightly concave or provided with a rim so that small weights or shot will not roll off. On pages 82 and 83 are illustrated balances meeting these requirements. The beams are of aluminum and the pans are of thin metal with turned rim, to give them rigidity and lightness.

(d) Forty fifty-pound weights, or forty twenty-five kilogram test weights, for testing large weighing machines, as

hay, wagon, cattle, or railroad scales. These may be made of steel or iron. One necessary qualification is that they be so made that they shall not easily catch dust, dirt, or snow.

The ordinary weight with a lead-plugged hole in the bottom is valueless as a sealer's standard.

(e) A Set of Weights from fifty to five pounds, or from twenty-five to two kilograms, for testing small platform, counter, and spring scales. (See page 73.)

(f) A Set of Test Weights from four pounds to one-sixteenth of an ounce, or from one kilogram to one gram, for testing small commercial weights or small counter balances. (See page 62.)

(g) A Set of Fractional Gram Weights or Grain Weights (page 65), for testing the sensitiveness of balances.

(h) A Standard Length Measure, divided for thirty-seven inches into thirty-seconds of an inch, or for one hundred and one centimeters into millimeters, or both. The measure should be arranged with a fixed stop at one or both ends. (See pages 46-49.)

(i) Liquid Capacity Measures, from one gallon to one gill or from four liters to one deciliter. These must be of rigid construction, particularly the bottom, which should not be made of thin sheet metal without having strengthening ribs. (See page 95.) The top should have a smooth flat rim, in order that a "slicker" plate may be used.

(j) Dry Capacity Measures from one-half bushel to one-half pint, or from four dekaliters to one-half liter. These test measures should be cylindrical in shape with a rigid bottom and rim. The top should be smooth, in order that a "slicker" plate or striking stick may be used. (See pages 99, 100.)

(k) A Hopper Funnel (see page 101) suitably mounted and provided with a metal cut off, to be used in testing dry measures.

(l) A Dry Measure Gauge, for measuring the depth and diameter of dry measures. (See page 105.)

(m) Steel Letter and Figure Dies, for sealing weights, measures, and scales. (See page 107.)

(*n*) Steel Dies, for stamping condemned measures, etc. (See page 107.)

(*o*) A Rubber Stamp, for marking glass bottles with glass ink. (See page 113.)

(*p*) Printed Gummed Labels, for marking balances and scales. (See page 128.)

(*q*) Glass Ink, for marking glass vessels, such as milk bottles, glass measures, etc. (See page 113.)

(*r*) A Combination Drill and Clamp with the necessary drills, to be used in adjusting weights. (See page 117.) This may be screwed to a table or wagon bed or fastened with the clamp to any shelf or ledge.

(*s*) A Vise. (See page 115.)

(*t*) A Lead Covered Anvil or stake iron. (See page 111.)

(*u*) A Sealer's Kit. (See page 122.)

On a tour of inspection the sealer should take with him the following apparatus:—A portable balance (see page 82); a set of small weights 4 pounds to $\frac{1}{16}$ ounce, (see page 62); a set of large weights 25, 10, and 5 pounds (see page 73); when necessary, forty fifty-pound weights (see page 78); small dry measures (see page 102); the smaller liquid measures (see page 95); dry measure gauge (see page 105); standard length measure (see page 48); dies (see page 107); labels (see page 128); sealer's kit (see page 122); a vise (see page 115); an anvil, which should be easily attachable to the wagon or cart, one of which the sealer will find is essential for the transportation of his apparatus; a copy of the laws of his locality which refer to weights and measures and their inspection, and a HANDBOOK.

NOTE.—*Besides the separate items enumerated above, the sealer should be provided with carrying cases (see page 85) for a part of his apparatus. The style of these may vary from a simple wooden case to an elaborate one of leather.*

The above list includes those articles which are absolutely necessary, but by no means all that he should have. A sealer can never have too many standards. He should certainly have customary and metric weights and measures as

well as Troy weights for testing bankers', jewelers' and apothecaries' weights.

It is essential in all cases to have office standards separate and distinct from the working standards.

LINEAR MEASURES

Linear measures may be divided in two classes, each with subdivisions :

1. Rigid Measures.
 - (a) One piece non-metallic end or line measures.
 - (b) " " metallic " " "
 - (c) Folding non-metallic " " "
 - (d) " " metallic " " "
2. Flexible Measures.
 - (a) Tapes of metal or cloth.
 - (b) Chains.

Any measure of whatever type should be made in such a manner and of such material that, under ordinary conditions, variation in its length should not exceed a certain allowable error or tolerance. (See page 99).

RIGID MEASURES

INSPECTION. All warped or bent measures should be condemned. All non-metallic measures without metal end pieces should be condemned.

Counter measures made by driving upholstery or other tacks or nails into the counter should not be allowed in any case.

All measures should be permanently and clearly marked by engraving, etching, or stamping, and the length of the measure should be definitely indicated.

Folding measures should be so constructed that the joints come to a definite position when opened.

Metallic measures should be carefully ground flat and straight.

TESTING. Linear measures are to be tested by comparison with the standard measure.

End measures are laid on the scaler's standard between the stops or with one end against the end stop, the position of the other end is then read on the standard. If the allowable error is not exceeded (refer to the table of tolerance, page 134), it should be scaled.

A yard measure should fit between the two end stops without too much shake. With a little experience the sealer can easily estimate this.

Line measures are laid beside the standard and the variations noted. A number of intermediate dimensions taken at random should be compared. If the amount of error is to be more carefully determined a close reading may be taken by using the small vernier (see page 47) in connection with the standard. Still closer determinations may be made by using the comparator, which should be in the office of the State Sealer, or by sending the measure to the National Bureau of Standards for comparison.

SEALING. When the measures have been tested and found satisfactory, they should be sealed by stamping with a steel sealing die (see page 107), and the letters may be filled with a colored crayon or wax. (See page 103).

FLEXIBLE LINEAR MEASURES

INSPECTION. Only tapes made of metal or of cloth, interwoven with wire and rendered waterproof, should be accepted.

The beginning and end divisions should be clearly defined and should not coincide with the end of the ring or handle.

Chains should be made of steel with brazed links, and in every case the length should be clearly marked on the handle.

TESTING. Tapes are tested by laying them on the standard measure or on a standard bar (see page 49), which should be in possession of the State Sealer. They may be verified also by laying on the floor beside a standard steel tape (see page 51) and the points of coincidence carefully noted. If the variations are greater than the allowable errors (see page 134) the tape or chain should be rejected, otherwise it should be sealed. The stretching force as measured by a spring balance and the temperature should be carefully noted.

SEALING. Tapes and chains should be sealed by stamping the handle or metal fastening near the handle with a steel sealing die. Stamping the case of a tape is not sufficient.

WEIGHTS

For convenience, commercial weights may be classed as follows :

1. Ordinary Commercial Weights.
2. Jewelers', Apothecaries', and Bankers' Weights.

ORDINARY WEIGHTS

INSPECTION. These weights should be so constructed as to give evidence that they will not be seriously affected by atmospheric conditions nor by the usual handling. They should be made of iron, painted or plated ; of steel, painted or plated ; of brass, or of any substance of like hardness.

Weights should not present any sharp corners or angles liable to be easily worn or broken, or any places which would easily retain dust or dirt. Lead weights, unless encased in brass, copper, or like material, should not be allowed.

Weights larger than five pounds, or two kilograms, should be provided with handles, cast in, screwed or driven in, without the use of lead or other binding material. Weights under five pounds, or two kilograms, may be with or without handles.

Weights less than one-quarter ounce, or ten grams, should not be made of iron. When weights are adjusted by means of a lead plug, it should be firmly imbedded in the hole provided and be at least $\frac{1}{16}$ of an inch, or one millimeter, below the surface of the weight. All weights larger than one ounce, or twenty-five grams, should be clearly marked with figures of appropriate size to designate their weight.

TESTING. Weights of eight pounds, or four kilograms or less, should be tested by comparing them with the working standards (see page 62), making use of the portable balance (see pages 82, 83), which may be set up on any bench or counter. To set up balance No. 9560, raise the top, lift out the beam with suspended pans and hang it on the hook. Balance No. 9562 should be leveled before using.

If the weight does not come within the allowable error,

as given on pages 136 and 137, it should be rejected; or if the sealer sees fit, he may adjust it by using the portable balance, drilling the necessary holes in the weights by means of the portable drill (see page 117), and if necessary adding lead, being careful to drive it in firmly with a punch (see page 117).

Weights over eight pounds, or four kilograms, may be taken to the office of the sealer for verification, where the large office balance (see page 85) is available, or in an emergency they may be tested by making use of the large weights and an ordinary balance that has been tested and sealed.

SEALING. Weights found satisfactory are sealed by stamping the initial of the town or county and the year with a steel die (see page 107) on the top of the weight and on the lead plug, if it be exposed. Condemned weights should be clearly stamped "CD" or "CONDEMNED" on both sides with a fair sized die (see page 107). It is advisable for the sealer to take these latter weights away with him.

JEWELERS', APOTHECARIES', AND BANKERS' WEIGHTS

INSPECTION. These should be made of brass, bronze, or nickel-plated iron or steel. The knob may be screwed, driven, or cast in the weight. In other respects the same precautions are to be observed as for ordinary weights (see page 19.)

TESTING. As these weights should be more carefully adjusted and tested than the ordinary store weights, it is perhaps better that the sealer should take them to his office and adjust them on his large or small balance (see page 85). In case the sealer is in doubt, he should send the weights to the State Sealer or to the National Bureau of Standards, for, if the sealer is not prepared to seal these weights, he had better not undertake to do so.

SEALING. Whenever possible, each weight should be stamped on its top surface with a steel die.

NOTE.—Precision weights used in accurate physical and chemical work and the sealer's fundamental office standards should be sent to the State Sealer or by him to the National Bureau of Standards.

BALANCES AND WEIGHING MACHINES

For convenience in discussion, balances may be divided as follows:

1. Equal arm balances.
 - (a) Load suspended below the beam.
 - (b) Load above the beam.
 - (1) With side beam.
 - (2) Without side beam.
2. Unequal arm balances.
 - (a) Load suspended below the beam.
 - (b) Load above the beam.
 - (c) Compound lever type.
3. Spring balances.
4. Computing scales.
5. Torsion balances.

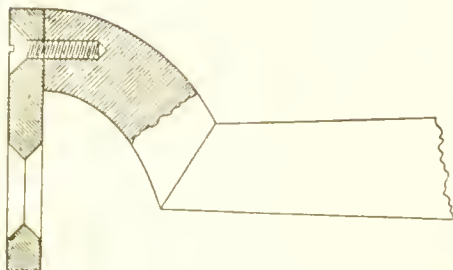
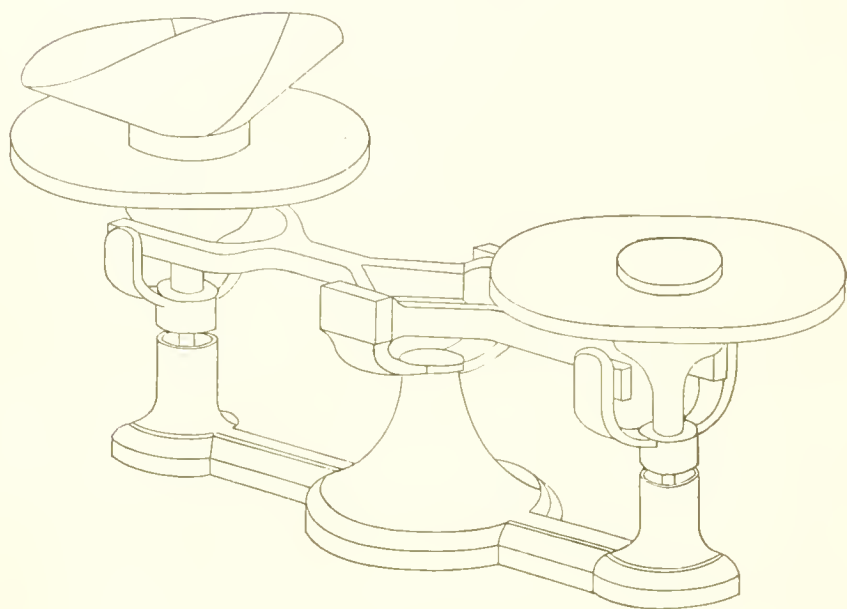
Type 4 may be of any of the preceding forms or a combination of them, together with some computing device more or less automatic and more or less complicated.

NOTE.—In all cases where the balance or the weighing machine is found unsatisfactory and is condemned, it should be tagged, clearly indicating that its use is prohibited unless it is put in working order and then properly sealed.

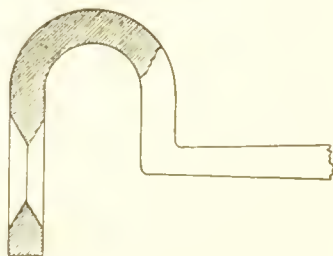
EQUAL ARM BALANCES WITH LOAD BELOW THE BEAM

INSPECTION. The beam should be symmetrical about the central supporting knife-edge. All knife edges are to be sufficiently hard to withstand a file. They may be of agate or steel, and should be firmly attached. The bearings may be of chilled iron, agate, steel, or other like hard material. If the beam is of the so-called goose-neck type (see fig., page 22) the bearings or knife edges must be separately attached and not be simply a hardened part of the beam, because in such cases the part immediately adjoining the hardened portion becomes damaged in quality even though not outwardly apparent. Adjusting screws should be locked and so placed that they are not readily moved, accidentally or intentionally.

The central support should be rigid and firmly fastened



ONE METHOD OF PROPER CONSTRUCTION.



IMPROPERLY CONSTRUCTED.

to the counter or supporting base. Balances of this type may be hung over a hook with a pointer projecting upward, or may be supported by a central pillar with the pointer projecting downward or sidewise.

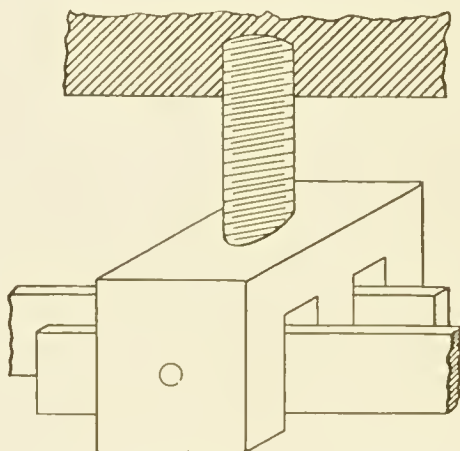
TESTING. First see that when both pans are empty the pointer indicates zero or vibrates an equal distance on either side of the zero when in equilibrium. Place equal standards in each pan, equal to about half the capacity of the balance. Make the balance vibrate through a considerable arc and observe if it recovers itself rapidly, and whether the pointer comes to the same position as when there is no load on either pan. If this test is satisfactory, determine by means of the small weights, namely, the fractions of an ounce, grains or metric weights, how much is required to cause a decided movement of the pointer. This weight should be at most one-five-hundredth of the maximum load of the balance.

SEALING. If the balance is found satisfactory, a gummed label seal (see page 128) may be placed in a conspicuous place on the support of the balance, or it may be marked with a steel die if a special place is provided therefor. Sometimes difficulty is experienced with gummed seals by their not properly adhering. This is due to the presence of grease on the parts of the balance and the difficulty may be entirely overcome by wiping the place where the seal is to be attached with a cloth moistened with a soda solution. Often it is convenient to attach a wired lead seal (see page 104). In no case mark the beam unless a place is specially provided for such marking.

EQUAL ARM BALANCES WITH LOAD OVER THE BEAM

INSPECTION. These balances may be with or without a side beam. Inspect the knife edges and bearings as described on page 21. The balance should in no case have a scoop with a corresponding counterpoise. If a scoop is used it should form a part of the balance. All balances of the form shown in the figure on page 22 should be rejected, because the simple omission of the separate counterpoise for

the scoop introduces a serious error. Any adjusting screws should be placed so that they cannot be moved easily.



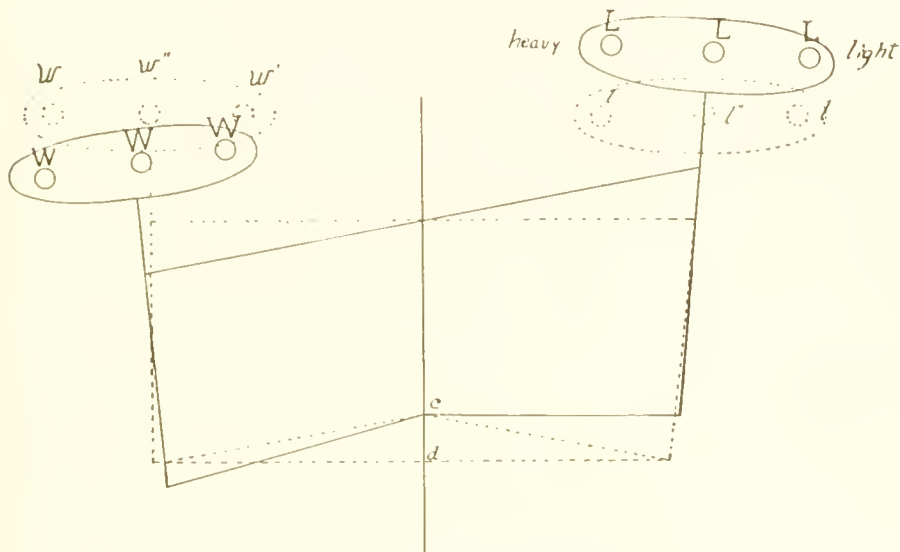
A form of equal arm balance often used is the so-called Roberval type. This form of balance may cause error. Often such balances are so constructed that the lower connecting rod is in two pieces, with the joint adjustable in height (see figure above). In that case the beam and the connecting or tie rod may not be parallel, and the balance will give varying results, depending on the position of the weights and goods on the pans. (See page 25.)

If a side beam is affixed to the beam, the divisions should be equally spaced and the sliding poise should not be removable from the balance. The side beam should have a shoulder on the ends, so that the hanging poise cannot be slipped off over the ends.

TESTING. Tests for balances of this type should be made according to the instructions given on page 23. In addition, place equal standards in the center of each platform pan, or weight plate, then shift one to various parts of the platform; if the balance is properly constructed equilibrium will exist wherever on the pan the weight is placed. The sensitiveness should be at least one-five-hundredth part of the maximum load. The two pans may generally be unscrewed, and if there is a lack of balance due to the unequal weight

of the two ends, they may be balanced by adding or taking out lead from the cup under the pans.

SEALING. If satisfactory, affix a gummed label seal in a conspicuous place on any of the rigid parts of the balance or attach a lead seal.



The figure shows a Roberval Balance with the lower central pivot raised from *d* to *c*, thus destroying the parallelogram on which the balance depends for its accuracy. The dotted lines show the position of the distorted balance in equilibrium, the solid lines the balance out of equilibrium. An inspection of the diagram shows that if a weight is placed at *W*, it will descend through a greater distance than a load placed at *L*, thus giving *W* a greater influence; placing a weight at *W'* and the load at *L* gives *L* a greater influence; when the weight is placed at *W''* and the load at *L''* the effects *may* be equal.

The operator has it in his power, in this case, to weigh light or heavy, depending on the position of the weight and the load in the pan. If the weight is placed in the center of one pan, and the load on the outside of the other, it will weigh light; if the load is on the inside of the other pan it will weigh heavy.

UNEQUAL ARM BALANCES WITH THE LOAD SUSPENDED BELOW THE BEAM

INSPECTION. If the pans are attached, test according to the method described on page 23.

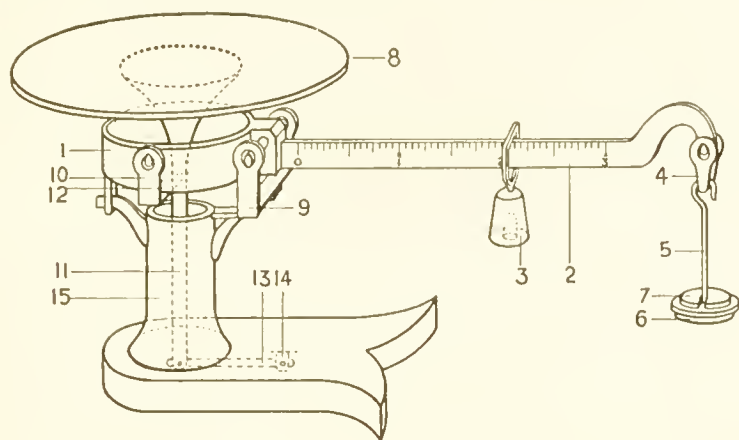
If the balance is of the form known as a steelyard, carefully note if the divisions correspond with the notches and if they are equally spaced. Examine the bearings and knife edges as to hardness. (See page 21.)

TESTING. Unequal arm balances without a sliding poise are to be tested by placing known weights in both pans and observing whether the same ratio holds, whatever the weights; for instance, if the lengths of the arms are in the proportion of ten to one, then one pound placed in one pan should produce equilibrium with ten pounds placed in the other, or a one-ounce weight in one pan should produce equilibrium with ten ounces in the other.

Steelyards generally have a hanging or bush poise, which indicates directly on the beam the weight suspended on the other side of the supporting knife edge. Suspend successively known weights, balance them with the hanging or bush poise and see that the indicated readings are correct.

OR take the standard one-pound hanger weight (see page 117) and place it on the divided arm of the steelyard and suspend a known weight from the hangers or hooks. Test with various loads. It often becomes necessary with large steelyards to use a special platform made of a strong wooden frame and suspension ropes, on which the fifty-pound test weights may be placed.

SEALING. Seal by affixing a gummed label seal to a rigid part of the balance, or attach a wired lead seal.



In a balance of the above form the parts are usually designated as follows:

1, Beam Head; 2, Beam; 3, Poise; 4, Counterpoise Loop; 5, Counterpoise Stem; 6, Counterpoise Cup; 7, Weight; 8, Plate; 9, Tall Bearing Post; 10, Short Bearing Post; 11, Cross Bar Post; 12, Cross Bar; 13, Check Rod; 14, Check Rod Holder; 15, Stand.

UNEQUAL ARM BALANCES WITH THE LOAD ABOVE THE BEAM

INSPECTION. Inspect the knife edges and the bearings as described on page 21. These balances are generally provided with one pan and a poise (see above), which is read directly on the beam, as in the steelyard.

If a separate scoop with additional equivalent counterpoise is used, the balance should be rejected, as by the omission of this counterpoise an error easily would arise. Examine the divisions on the beam, see that they are equally spaced and that the sliding poise is not readily detachable.

TESTING. Place a known weight on the pan and produce equilibrium by the sliding poise. Note the reading, which should agree with the weight placed on the pan. No change of equilibrium should result wherever on the pan or platform the weight is placed.

The divided beam must vibrate freely, and when disturbed must return to its normal position quickly and accurately. The pointer or beam should show a decided movement when a weight equal to one-five-hundredth of the maximum capacity of the balance is placed on the pan.

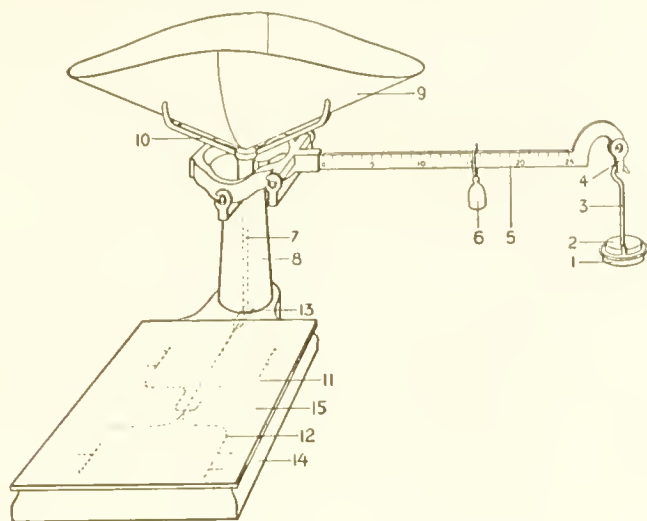
SEALING. If satisfactory, affix a gummed label seal to some rigid part of the balance, or use a wired lead seal.

COMPOUND LEVER TYPE BALANCES

INSPECTION. This includes almost all forms of platform scales, whether dormant (built in place) or portable (see pages 29 and 31). Great care must be exercised in inspecting and testing these scales, as a small variation in the weight used on the counterpoise may cause a considerable error in the load weighed. For instance, if the load and the counterpoise are in the ratio of one thousand to one, then an error in the poise of one ounce will cause an error in weighing of one thousand ounces, or $62\frac{1}{2}$ pounds.

The platform may be removed and the under structure examined to see if any levers are broken, if the edges are in good condition, check rods bent, etc. The scale should present no outward evidence of having been tampered with.

Large wagon, coal, railroad track, grain elevator, and hay scales frequently need cleaning. The sealer should have a cleaning blade (see page 121) to pass around the platform to remove small pebbles, dirt, coal, etc., that may have become lodged there.



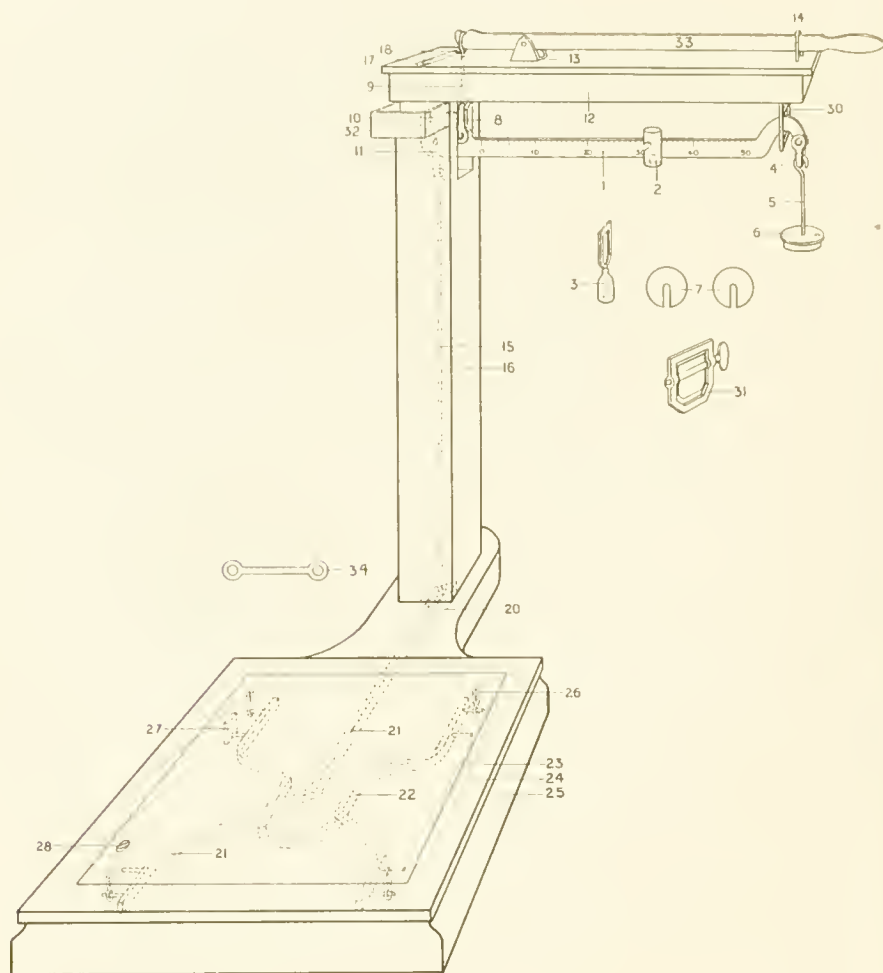
In a counter platform or "Union" scale the various parts are usually designated as follows:

1, Counterpoise Cup; 2, Weight; 3, Counterpoise Stem; 4, Counterpoise Loop; 5, Beam; 6, Poise; 7, Cross Bar Post; 8, Pillar; 9, Scoop; 10, Cross; 11, Short Lever; 12, Long Lever; 13, Nose Iron; 14, Frame; 15, Platform.

TESTING. Place the level (see page 106) on the platform and note if it is approximately horizontal, if not, it should be made so before the sealer proceeds with his test.

In the case of a small platform scale, raise the ends of the platform slightly with a large screw driver or with the fingers, so as to free all bearings, and let them come together in a natural position; in the case of a large scale, give the platform a good shake to and fro.

With no load on the platform, with the poise slid back to zero on the beam, and with no weights on the counterpoise, move the balance ball until it vibrates equally between the stops of the loop.



Place a test weight (ten lbs. for platform scales of 250 lbs. and under, 50 lbs. for scales of a capacity up to 1500 lbs.; and 200 lbs. or four 50-lb. weights for scales having a capacity over 1500 lbs.) in succession on each of the four corners of the platform and note the readings of the beam. If the readings are not all alike, it indicates that the bearings or edges supporting the platform are not in the same plane, and should be attended to by a scale maker.

Hang a one pound hanger weight (No. 10275) in the counterpoise loop and place weights on the platform until the beam is in balance. This will determine the leverage of the scale; for instance, if it takes 100 lbs. on the platform to balance a 1-lb. hanger weight then the leverage is 100 to 1 (the value of the leverage is generally indicated on the counterpoise weights and will aid the sealer).

NOTE.—The accompanying figure, page 30, shows the various parts of a small platform scale, the various parts being designated as follows:

1, Beam; 2, Poise; 3, Bush Poise; 4, Counterpoise Hanger; 5, Counterpoise Stem; 6, Counterpoise Cup; 7, Weights; 8, Fulcrum Loop; 9, Fulcrum Lever Beam Hook; 10, Balance Ball; 11, Beam Rod Loop; 12, Drop Lever Cap; 13, Fulcrum Lever Stand; 14, Fulcrum Lever Hook; 15, Beam Rod; 16, Pillar; 17, Strap Washer; 18, Pillar Rod Nuts; 20, Nose Iron; 21, Long Lever; 22, Short Lever; 23, Platform Board; 25, Frame; 26, Loop and Link for Levers; 27, Bearing Block; 28, Screw and Block; 30, Cap Loop; 31, Trig Loop; 32, Drop Lever Cap and Weight Frame; 33, Fulcrum Lever; 34, Check Rod.

If the leverage is not correct lengthen or shorten the long lever by using the nose iron wrench (see page 118) and adjusting the screw of the nose iron.

NOTE.—In large scales each lever is provided with a nose iron and each lever is independently adjustable, the ends of the two long levers resting in a shackle; in short, all four corners of the scale must be adjusted. If there is not enough motion of the nose iron, the beam must be lengthened or shortened by prying out or pressing in the curved end of

the beam where the counterpoise is attached. If, however, the scale is as faulty as this, it is advisable to put it in the hands of a scale maker.

The platform being level, the bearings all in a plane and the leverage being correct and the scale being in balance for no load on the platform, place a load on the platform equal to the capacity of the divisions of the beam, and note if the poise gives the correct reading; if not, the cork or screw may be removed and an amount of lead added or taken off until the proper reading is indicated.

Having adjusted the poise to give correct readings on the beam, and knowing the leverage of the scale, it only becomes necessary to very carefully test the counterpoise weights, which are tested against standards on a portable balance. (See pages 82-83.)

Ordinarily, the sealer should not attempt to grind or sharpen the knife edges, but should recommend to the owner that it is best to have the original maker put it in order if it needs radical overhauling.

SEALING. If satisfactory, the gummed label seal should be affixed to the front of the pillar or a wired lead seal attached.

SPRING BALANCES

INSPECTION. Spring balances are of the straight or dial front type. They are largely used by grocers, butchers, icemen, and peddlers. They are particularly liable to error on account of the lack of permanency of the spring, which will become deformed by long use or rough handling. The straight front type lends itself especially well to fraudulent weighing: the upper support holding the spring, may be loosened and thus the weight indicated is at the command of the dealer; the front may be detached, forming a sliding piece; the index may be bent, and the front or lower end of the spring bent or twisted to produce friction; an additional heavy hook may be hung on the lower end to give a constant error; a rubber band may be attached to the back of the balance and connected with the lower end of the spring; and a thousand other devices may be used. Spring

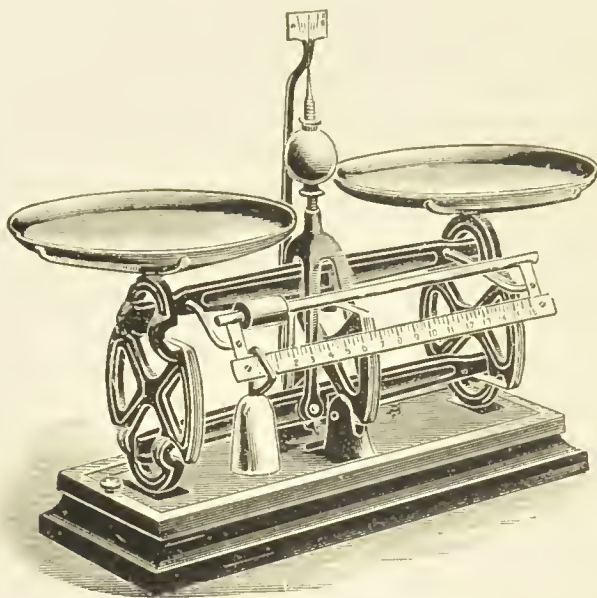
balances having an adjusting screw readily accessible and easily handled should be condemned. Spring balances should be very carefully inspected.

TESTING. If there is no evidence of fraud, the balance should be tested by placing weights up to the maximum load on the pan, shifting them to various parts of the pan, or by hanging them to the hook and noting if the indications agree with the weights used.

The dial forms of these spring balances may often be put in order, if the rack and pinion gear is not worn out, by cleaning the interior. To adjust the pointer, the cover must be removed, and the special wrench (see page 118) applied, turning it to the right or left, as the case may be.

Always test a spring balance for friction, to see if the bar attached to the hook binds or rubs. Furthermore, always test the scale in the manner in which it is used.

SEALING. A gummed label seal should be affixed in a prominent place.



TORSION BALANCES

INSPECTION. Torsion balances make use of the torsion or twist of a wire or metallic band, substituting this for the knife edges in the ordinary type of scale. A balance is thus produced which is sensitive and very quick in its action.

The sealer should see that the springs are not broken, and that there are no loose parts or no parts interfering with the action of the beam.

TESTING. If the balance is an even arm balance, test in a manner similar to that outlined on pages 23, 24. If there is a side beam test the poise as indicated on page 24.

The pans may be unscrewed and then there is room for a slight addition of lead if necessary. If any of the springs are broken, the balance should be returned to the makers for repairs.

SEALING. If the balance is correct it should be sealed by affixing a gummed label seal.

COMPUTING SCALES

INSPECTION. There are undoubtedly many very good computing scales.

Weighing in general should not be complicated by unnecessary adjuncts. As a rule, the simpler the balance the more accurate and permanent it is. Note if the balance has any adjusting screw by means of which the readings might be readily or even accidentally changed.

TESTING. These balances should be tested as any ordinary scale of the class to which they belong, and if not sufficiently sensitive they should be condemned. In every case the owner of the balance should have the original maker repair it, when in the judgment of the sealer such repair is possible.

LIQUID CAPACITY MEASURES

Liquids are almost altogether sold by capacity, not by weight. If all measures of a certain denomination had a definite geometrical shape with a fixed ratio between the diameter and the height, the method of checking liquid measures would be very simple. But in trade, measures of various shapes occur, and the simplest test is to compare the measure directly with one of known capacity by the use of water.

Liquid measures may be divided, for convenience, into six classes :

1. Ordinary retail measures.
2. Milk measures.
3. Oil measures.
4. Casks and churns.
5. Flasks.
6. Automatic devices.

ORDINARY LIQUID RETAIL MEASURES

INSPECTION. The measures should be strong enough to hold their shape and not be easily deformed or indented. Metal measures, other than aluminum or iron, should be thoroughly tinned or nickel-plated, and earthenware vessels thoroughly glazed. Measures with flexible bottoms should not be allowed.

All measures should be pouring measures, that is, they should pour out the contents of the capacity indicated. An error commonly found in molasses and paint measures is that the commodity has so caked in the bottom or adhered to the sides that the quantity poured out is far short of what it should be.

TESTING. The testing of liquid measures of large denominations should be done preferably at the sealer's office. If the measure has been accepted after the above inspection, it must be tested, and for this purpose it should not be washed or cleaned. The standard measure should be filled with water even with the top.

The fullness may be judged by the eye, or, better, by using a flat glass "slicker plate," with which the full measure is covered by sliding the plate over the top, care being taken that no bubbles form. The water should then be poured from the standard into the measure to be tested. Any water that may be left in the standard should be poured into a glass graduate, thus determining the deficiency, or if it should take more than the standard full, water should be poured from the graduate until the measure is full, and the amount that is necessary to fill the vessel noted. The amount lacking or in excess having been determined, the table of tolerance should be consulted (see page 135), and if the measure does not come within the allowable error it should be rejected. If it comes within the allowable error it should be sealed. In no case should anything but water be used with a standard measure. If the measure is cylindrical, it may be tested with the gauge (see page 105) or rule, by measuring the diameter and depth. Then, by using the tables on pages 151-175, etc., the calculated capacity is found. The table of tolerance on page 135 will show whether the measure should be sealed or not.

Measures larger than one gallon should be tested in a similar manner, the standard having to be filled more than once, however, in such cases. It should always be noted carefully how full a store measure is usually to be filled. For instance, a five-gallon can or jar may hold the indicated capacity when it is full only to a certain mark and not to the brim.

NOTE.—Some sealers undertake to straighten bent metal measures; in such cases the straightening irons described on page 111 would be a necessary part of the office equipment.

SEALING. The measures which prove satisfactory after the inspection and test should be sealed. A metal measure should be placed over an iron sealing piece or stake (see page 111) and with a steel die (see page 107) stamped with the proper seal. If the measure is of glass, glazed earthenware or enameled ware it should be sealed with a lead seal (see page 114). If rejected, the measure should be condemned and marked or stamped "CONDEMNED."

MILK MEASURES

INSPECTION. In all cases it would be advisable to have dairymen send their new bottles to the sealer's office before they are put into service. If sent from the manufacturer to the sealer it avoids unnecessary delay and future complications.

Milk measures in the form of ordinary measures should be inspected and tested according to the instructions given for inspection on page 37.

Milk bottles should be of clear glass, free from cracks or chips. Metal cans should have heavy bottoms, or, better, reinforced by metal strips. When provided with a faucet, it should be so arranged that the can may be emptied without unnecessary effort. All cans with a capacity of five gallons, or twenty liters or more, should be provided with handles.

TESTING. The measures should be tested by the method described on page 37. All bottles should have a specified capacity when full to the bottom of the rim, that is, to the lower edge of the cap or stopper, in order that they may contain the requisite amount when full.

When many milk bottles have to be tested the comfort of working will be increased by using warm water instead of cold.

SEALING. Metal measures should be sealed according to the method described on page 37. Milk bottles should be stamped or marked with etching ink (see page 113).

OIL MEASURES

INSPECTION. Oil measures should be inspected according to the method described on page 37. When a spout or faucet is provided, it should be rigidly connected with the body of the measure and so placed that the measure is completely emptied without unnecessary effort. The bottom should be rigidly constructed and the larger measures reinforced with metal strips or bands.

When examining large oil tanks, the sealer should be careful to see that they are tight.

TESTING. Small measures should be tested according to the method given on page 37. In testing large oil tanks for contents, or for a check on a measuring stick, it will be far more convenient to have an accurately tested and constructed five-gallon or twenty-liter bucket measure. (See page 104). This should be provided with a spout and be rigidly constructed, as the oil companies require that the tanks be very carefully tested before making a gauge rod for the particular tank in question.

SEALING. The measure, when satisfactory, should be sealed by stamping with a steel die or lead seal.

CASKS, CHURNS, ETC.

INSPECTION. Casks should be strongly made with the capacity and the net and tare weight burned or stamped into the head. Churns need not be so marked.

TESTING. Casks may be tested by repeatedly filling from the largest size standard capacity measure, or by filling from a special tank of known capacity. Such a tank is provided with a registering device, and a faucet from which the water flows into the cask. Or the test may be made by using a platform scale on which the cask is weighed, first empty and then filled with water. From the known weight of water per gallon or per liter the contents may be calculated (see page 146).

SEALING. A cask or churn should be sealed by stamping or burning near the opening.

GLASS GRADUATES, APOTHECARIES' MEASURES, ETC.

INSPECTION. Glass graduates should be transparent and free from flaws or cracks. There should be no noticeable contraction where the graduations are made, and these should be clearly etched into the outside of the measure and never painted or otherwise affixed. The faucets should be of glass and ground or sealed into the vessel without the use of a foreign substance.

TESTING. Such measures should be tested as indicated on page 37, but by using standard glass graduates (see page 89). In reading the surface of the liquid measure, it

should be held in such a manner that the surface is horizontal and the graduation mark even with the surface of the water.

For small measures or graduates, burettes with glass stop cocks should be used. (See page 88). The burette should be placed in its holder (see page 88), filled with distilled water, the stop-cock opened and a drop or two allowed to flow out. The reading of the water level in the burette should then be taken, after which the graduate to be tested should be placed under the cock and water allowed to flow into it slowly, until the water level is exactly even with the graduations. The water surface in the burette should be read and from these readings the exact amount of water allowed to flow into the measure is found. This should correspond with the capacity value etched on the measure under test. Seal or condemn by marking with etching ink.

It should be remembered that apothecaries' measures must be accurate, as they are so frequently used in the compounding of prescriptions. For larger measures, glass measuring bottles (see page 88) should be used in testing. The bottle should be filled with water even with the mark on the neck and then the contents poured into the measure.

SEALING. The measure or graduate which is found satisfactory should be sealed with etching ink, immediately under the uppermost graduation.

AUTOMATIC DEVICES

INSPECTION. There are in use a number of automatic devices, such as measuring faucets, self-measuring pumps, measuring gates, etc. These should be inspected for loose parts, and in case of any doubt on the part of the sealer, he should refer the matter to the State Sealer, and he, if he be in doubt, to the National Bureau of Standards.

TESTING. The test of every automatic device should be repeated three times. A measure, which has been sealed, should be filled with the liquid used with the device, and if it does not give satisfactory results, the device should be rejected.

SEALING. Such devices should be stamped with a steel die as near the opening as possible.

DRY CAPACITY MEASURES

Dry capacity measures may be divided into the following classes:

1. Ordinary store measures.
2. Berry or fruit boxes and baskets.
3. Barrels and crates.
4. Baskets and bags.
5. Bins and salt carts.
6. Grain measures or cornometers.

ORDINARY STORE MEASURES

INSPECTION. A dry measure may be of wood, metal, or composition, but it must be strong enough to withstand ordinary usage and should not show any deformation. If of metal, except steel, the bottom and sides should be reinforced. Bottomless measures should not be allowed.

Particular attention should be paid to the appearance of the measure.

A wooden measure may have a false bottom inserted, or have the bottom reduced in size and the sides lapped. The latter case is always evident, because the machine nailing has been taken out and the lap imperfectly made. Many measures are sawed off at an angle, being deeper on one side than on the other. Many false measures are found with loose bottoms.

Metal measures are sometimes indented or provided with a raised or false bottom. Liquid capacity measures are used in place of dry capacity measures. When any evidence of fraud exists, the measures should be examined with special care.

Dry measures should always be striking measures, that is, when filled flush with the upper edge, they should have the required capacity.

TESTING. If the measure is cylindrical in shape, its capacity may be obtained by measuring its depth in three or four places and its diameter by means of a gauge rule (see page 105). The capacity may be determined by referring to page 151. The correct capacities and tolerances are given

on pages 174-175 and 135. If the diameter or depth is greater than any given in the table, the contents may be calculated by multiplying the depth by the square of the diameter (diameter multiplied by itself) and multiplying the result by .7854, giving the contents in cubic inches or cubic centimeters, according as the diameter and depth were measured in inches or centimeters.

If the capacity of the measure does not come within the allowable error it should be rejected.

Metal measures may be tested by using the method described on page 37.

Probably the best method of testing dry measures is by making use of a hopper funnel and coarse grain. The height of the hopper funnel (see page 101) should be adjusted until it is six inches from the upper edge of the measure to be tested and the standard placed under the funnel with the slide closed. The hopper should then be filled with grain or beans, the slide opened and the seed allowed to flow into the measure until it is full enough for striking, that is, passing a round rod called a striking stick over the top of the measure. The hopper funnel should then be emptied, the measure to be tested placed under it and the grain from the standard poured into the funnel, the slide opened and the grain allowed to flow into the measure under test until it is striking full. If the measure under test is not filled in this way, the amount of shortage may be determined by using a small dry measure or graduate. The measure should then be sealed or rejected according to whether it is within the allowable error or not.

SEALING. If the measure is satisfactory it should be stamped on the upper rim across the lap, and on the bottom inside and outside, or by burning on the side across the lap with a burning iron.

BERRY OR FRUIT BOXES AND BASKETS

INSPECTION. Berry or fruit boxes are often made with a false bottom or with the sides curved inward. They should be inspected for evidence of fraud.

TESTING. A small dry capacity measure standard (see page 99), or a berry measure (see page 102), should be filled with small fruit or coarse grain, which should then be poured into the box or basket to be tested. If there is a shortage, the box or basket should be rejected. There is more fraud practised in connection with berry boxes than with almost any other form of dry measure.

SEALING. It is not necessary to seal berry boxes as they are used but once, but the deficient boxes should be confiscated and the offenders punished.

BARRELS AND CRATES

INSPECTION. Barrels and crates should be strong enough to withstand ordinary handling by carrier companies.

TESTING. The laws of some States specify the legal weight of a certain capacity of various commodities. If the barrel or crate is supposed to have a definite capacity, it should be placed on a platform balance which has been sealed, and the capacity calculated.

SEALING. Barrels and crates may be sealed by affixing a gummed label seal (see page 128) or by burning with a burning iron (see page 112) or a stencil (see page 115).

BASKETS AND BAGS

INSPECTION. Baskets should be strong and rigid enough so that there shall be no appreciable deformation when they are filled or lifted.

TESTING. If a basket is of a regular shape the capacity may be found by measurement and calculation; otherwise, the basket should be weighed on a sealed platform scale when filled with the commodity to be sold by the measure, and also when empty. The difference in the two weights should agree with the legal weight of that quantity of the commodity.

Bags are frequently used in retailing charcoal, etc. The capacity of the bag should be clearly marked on the outside together with the dealer's name. When the sealer is suspicious that bags are undersized, he should measure them,

allowing six inches at the top for tying, and comparing the measurements with those of a bag found by test to contain the required amount.

SEALING. Baskets should be sealed by stamping or burning the rim. Bags of deficient capacity should be seized.

BINS

The capacity of bins is found by measurement with a rule (see page 106) and calculation.

GRAIN TESTERS OR CORNOMETERS

These instruments (see page 103) should be inspected partly as dry measures and partly as balances. The method for inspecting the cup is given on page 37, and that for the beam on page 31.

LENGTH STANDARDS

Our primary linear standards have been certified by the highest authority in the world, the International Bureau of Standards of Sevres, France. This bureau is the court of last resort on all matters pertaining to weights and measures. Every intermediate division of these standards has been certified and all of the linear standards made by us are referred to these. Comparisons are made on a comparator of exceptionally heavy construction and in a constant temperature room; thereby the highest degree of accuracy is obtained.

YARD STANDARD

No. 9000. This measure is made of ribbed bronze, combining lightness and rigidity. It is divided on one edge of the face for thirty-seven inches into thirty-seconds of an inch. It has a fixed stop at the zero end and another half way across the face of the bar at the thirty-six-inch mark. The measure is accurately divided and highly finished.

Price in wooden case, \$18.00

METER STANDARD

No. 9001. Similar to No. 9000, but divided for one hundred and one centimeters into millimeters. Price in wooden case, \$18.00

METER AND YARD STANDARD

No. 9002. Similar to No. 9000, but divided into sixteenths of an inch on one edge and millimeters on the other.

Price in wooden case, \$25.00



YARD STANDARD

No. 9003. Flat pattern, divided to thirty-seconds of an inch on a silver strip inlaid in bronze. Price in case, . \$24.00

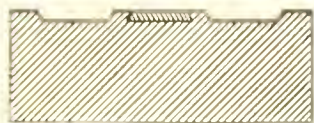
METER STANDARD

No. 9004. Flat pattern, similar to No. 9003.

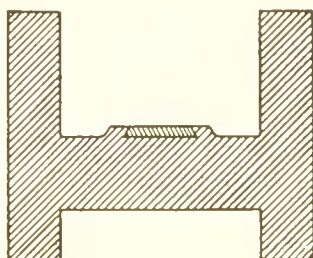
Price in case, \$24.00

YARD STANDARD

No. 9005. This measure is divided into thirty-seconds of an inch on a silver strip inlaid in bronze. The section is in the form of an H, and is similar to that used by the



9004



9005

International Bureau of Standards. This section gives the maximum strength and surface with minimum mass. The divisions are made along the neutral axis where they are little affected by flexure. Price, including case, . \$38.00

METER STANDARD

No. 9006. Similar to No. 9005. Price, . . . \$38.00

No. 9010. Vernier to be used in connection with Nos. 9000-9002. Price, \$5.00

NOTE.—The above measures are compared with our standards, furnished by the National Bureau of Standards.

We are prepared to furnish to order wooden measures of any form, also standard linear measures of nickel steel, which has a zero temperature coefficient of expansion, thus having an invariable length when the temperature is within ordinary range.

Prices on application.

YARD STANDARD

No. 9012. This yard standard is made of nickel-plated steel with bronze stops for inside and outside measurements. It is divided in inches and in fractions of a yard, the last inch being divided to thirty-seconds of an inch. Sealers find it very convenient as a gauge to rapidly and accurately test yard sticks.

The primary features that recommend this standard to sealers are convenience, accuracy, permanency, and *lightness*.

Price, \$12.00

METER STANDARD

No. 9013. Similar to No. 9012, but divided into centimeters, the last centimeter to millimeters.

Price, \$12.00

WOODEN YARD STANDARD

No. 9015. This sealer's yard standard is made of carefully-dried hard wood, one square inch in section, brass bound on the ends, provided with a stop and graduated for thirty-six inches into sixteenths of an inch. The fractional parts of a yard are graduated on the side. The standard is engine divided and tested. This is a most convenient and light working standard.

Price, \$3.00



9012

BENCH STANDARDS OF LENGTH

Every State Sealer and the Sealers of large communities should have, as part of their equipment, a standard length measure with which to compare long rods or tapes. We are prepared to make these, the price depending on the form and nature of the bar, on the method and style of mounting, and also on any accessories which may be desired.

Prices on application.

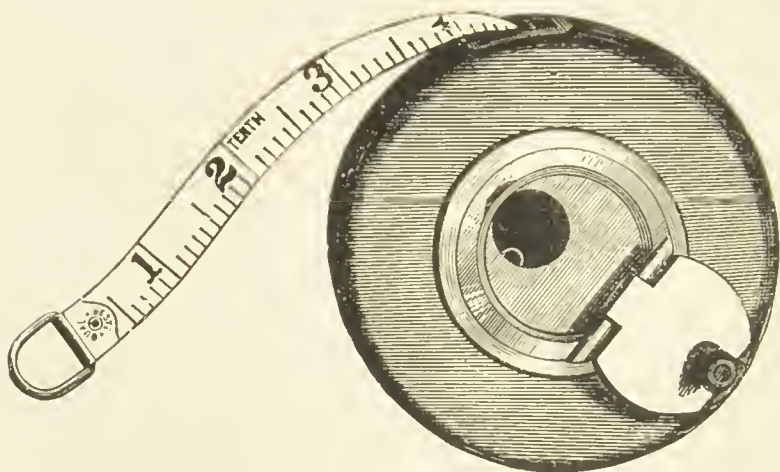
TAPE-STRETCHING DEVICES

We are prepared to make tape-stretching devices to order. These are to be used in connection with the bench standard in the accurate testing of tapes.

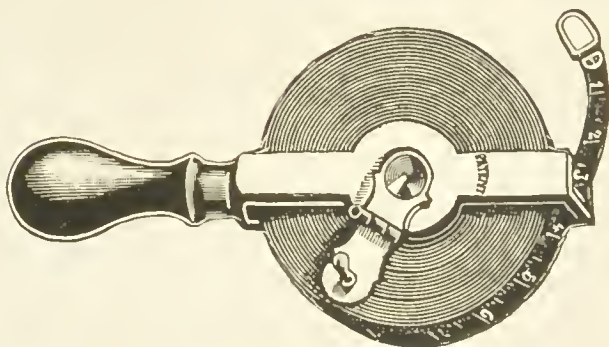
Prices on application.

MICROMETER MICROSCOPES

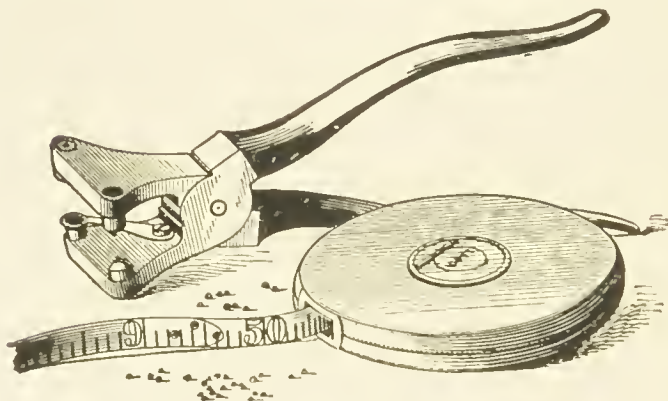
Micrometer microscope attachments to bench standards.
Prices on application.



9120



9131



9160

TAPES

STEEL TAPES

The sealer will have frequent use for a standard steel tape for sealing tapes and chains or in making long measurements.

No.	Make	Length	Width	Case	Price
9120	American	25 ft.	$\frac{3}{8}$ in.	Leather	\$3.75
9121	"	50 "	"	"	6.00
9122	"	100 "	"	"	10.60
9123	Star	25 "	"	Nickeled Brass	3.00
9124	"	50 "	"	"	3.00
9125	"	100 "	"	"	6.40
9126	Chesterman's	50 "	"	Leather, folding handle	7.20
9127	"	100 "	"	"	12.80
9128	Paine's	25 "	$\frac{1}{4}$ in.	Metal, folding handle	2.80
9129	"	50 "	"	"	4.80
9130	"	100 "	"	"	9.60
9131	Excelsior	50 "	$\frac{1}{2}$ in.	Brass Frame with handle	6.40
9132	"	100 "	"	"	11.50
9133	"	15 meters	"	"	7.65
9134	"	30 "	"	"	14.00

NOTE.—Metric tapes of similar lengths to the above at the same prices. The above tapes Nos. 9120-9130 are divided to feet, 10ths, and 100ths; or to feet, inches, and 8ths on one side and links on the other. Paine's tapes with metric or vara measure instead of links will cost two and a half cents per foot additional.

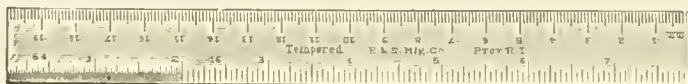
POCKET STEEL TAPES

DIVIDED TO 10THS OR 12THS			DIVIDED TO 10THS OR 12THS AND METRIC		
No.	Length	Price	No.	Length	Price
9150	3 ft.	\$1.00	9153	3 ft.	\$1.10
9151	6 "	1.40	9154	6 "	1.60
9152	12 "	2.50	9155	12 "	2.80

PUNCH AND SET FOR REPAIRING TAPE LINES

No.		Price
9160	Punch and riveter with eyelets,	\$5.00
9161	Eyelets (two lengths), 500 of each length,	1.25

STEEL SCALES, STANDARD QUALITY



9062

METRIC MEASURES

The 50 cm. scale has 5 cm. of each end of the first edge divided to .2 mm; the remainder of that edge, together with the other edges, is divided to 1 mm. The other scales are divided on one edge to .5 mm. and the remaining edges to 1 mm.

No.	Length	Price	No.	Length	Price
9050	5 centimeters	\$0.25	9053	30 centimeters	\$1.25
9051	10 "	.45	9054	50 "	2.00
9052	20 "	.85	9055	100 "	8.00

METRIC AND ENGLISH MEASURES

These scales have the first edge divided to 1 mm; the second to .5 mm., the third to .01 of an inch, the fourth to $\frac{1}{16}$ of an inch.

No.	Length	Price	No.	Length	Price
9060	10 centimeters	\$0.45	9063	30 centimeters	\$1.25
9061	15 "	.65	9064	50 "	2.00
9062	20 "	.85	9065	100 "	7.00

The four edges are divided in the following parts of an inch: 16, 32, 64, and 100.

No.	Length	Price	No.	Length	Price
9070	1 in.	\$0.15	9074	12 in.	\$1.25
9071	3 "	.35	9075	18 "	2.00
9072	6 "	.65	9076	24 "	2.50
9073	9 "	1.00	9077	36 "	5.00

BOXWOOD RULES

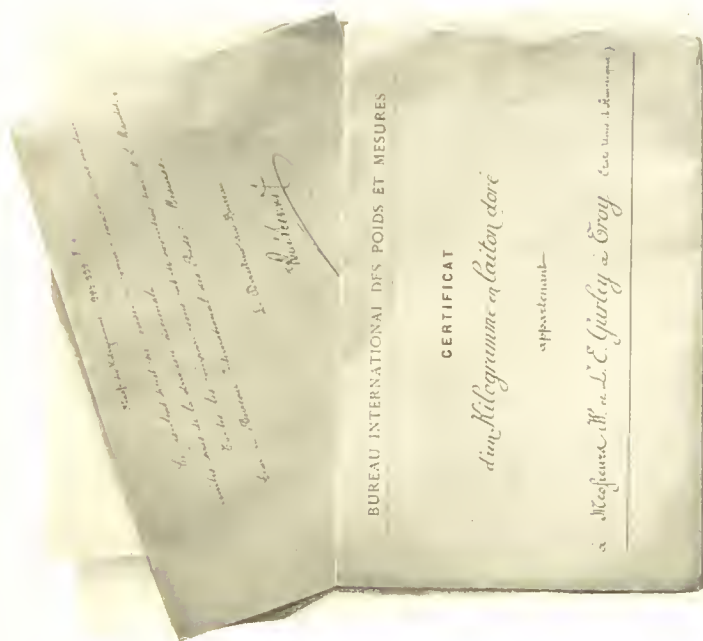
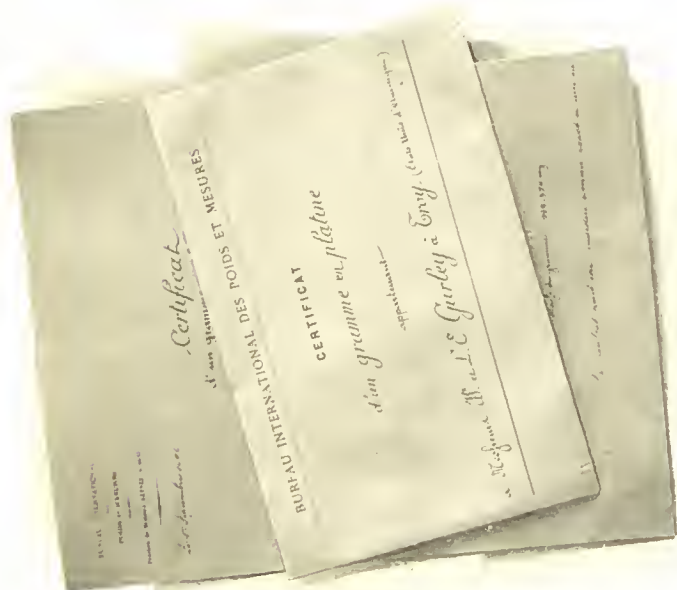
No.		Price
9163	Boxwood Rule, one foot, four fold, 8ths and 16ths of inches,	\$0.10
9164	Boxwood Rule, one foot, four fold, edge-plates, 8ths and 16ths of inches, . . . . .	.18



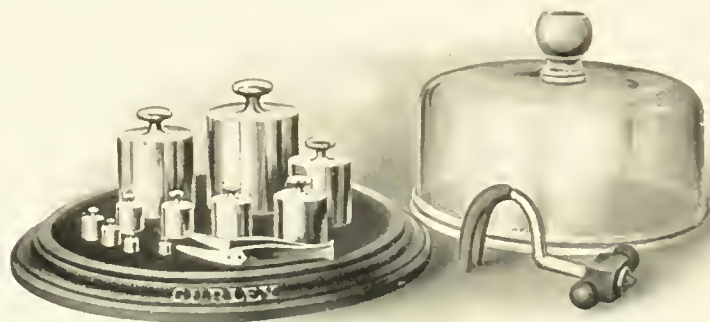
9165	Boxwood Rule, two feet, four fold, brass edges, bound, 8ths and 16ths of inches, . . . . .	.30
9166	Boxwood Rule, two feet, four fold, 8ths and 16ths of inches, . . . . .	.15
9167	Flexible Wood Rule, four feet, eight fold, divided to millimeters and 16ths of inches, spring joints, . . . . .	.50
9168	Flexible Wood Rule, same as No. 9167, and with white enamel finish, . . . . .	.60



Our primary standards of weight and of length, to which our working standards are referred, have been verified by the International Bureau of Weights and Measures at Sevres near Paris, and some of them by the National Bureau of Standards at Washington.



Certificates for the standard kilogram and standard gram illustrated on preceding page.



WEIGHTS

GOLD-PLATED PRECISION WEIGHTS

NATIONAL BUREAU OF STANDARDS DESIGN

These weights are made of one piece of Tobin bronze, carefully adjusted by means of gold plating. They are the highest type of precision weight, as they are made of one piece with no loose parts, and are unaffected by salts or acids. These weights are adjusted to within the limits of error prescribed by the National Bureau of Standards. (See page 138.)

METRIC WEIGHTS

No.		Range		Number of Weights	Price
9170	One	20	kilogram to 1 kilogram	6	\$129.00
9171	One	10	" " 1 "	5	84.00
9172	One	5	" " 1 "	4	54.00
9173	One	20	" " 1 gram	18	165.00
9174	One	10	" " 1 "	17	120.00
9175	One	5	" " 1 "	16	90.00
9176	One	1	" " 1 "	13	48.50
9177	One	500	grams " 1 "	12	38.50
9178	One	200	" " 1 "	10	26.25
9179	One	100	" " 1 "	9	22.00
9180	One	50	" " 1 "	8	19.00
9181	One	20	" " 1 "	6	15.00
9182	Two	20	" " 1 "	7	17.00
9183	One	10	" " 1 "	5	12.00

NOTE.—When sets are desired containing weights less than one gram, any of the above weights may be combined with any of the sets Nos. 9260 or 9261 or Nos. 9484 or 9485.

When the one-piece weights are adjusted to Class A, N. B. S. specifications, add ten per cent. to above prices. For details of classification see page 138.

Single weights similar to the preceding as follows:

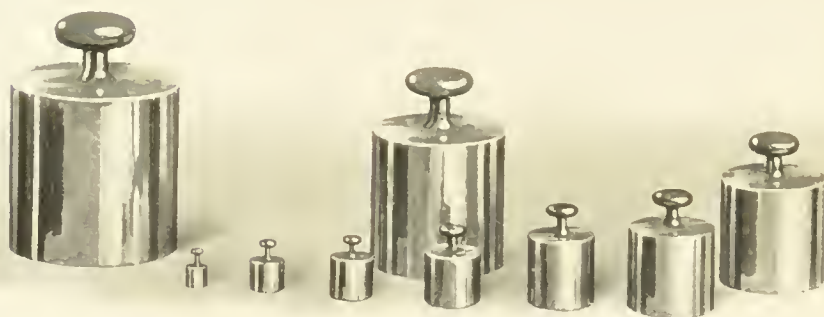
No.	Weight	Price	No.	Weight	Price
9190	20 kilograms	\$45.00	9198	200 grams	\$5.75
9191	10 "	30.00	9199	100 "	4.75
9192	5 "	19.00	9200	50 "	3.75
9193	4 "	17.00	9201	20 "	3.00
9194	3 "	15.00	9203	10 "	2.75
9195	2 "	12.50	9204	5 "	2.50
9196	1 kilogram	10.00	9205	2 "	2.50
9197	500 grams	7.50	9206	1 gram	2.50

FRACTIONAL GRAM WEIGHTS OF PLATINUM

No.		Price
9260	Set of weights, from 500 milligrams to 1 milligram (13 pieces),	\$6.25
9261	Set of weights, from 500 milligrams to $\frac{1}{10}$ milligram (17 pieces),	7.00

Single weights similar to the preceding as follows:

No.	Weight	Price	No.	Weight	Price
9266	500 milligrams	\$1.05	9272	5 milligrams	\$0.30
9267	200 "	.85	9273	2 "	.30
9268	100 "	.70	9274	1 milligram	.30
9269	50 "	.50	9275	$\frac{5}{10}$ "	.30
9270	20 "	.40	9276	$\frac{2}{10}$ "	.30
9271	10 "	.30	9277	$\frac{1}{10}$ "	.30



AVOIRDUPOIS WEIGHTS

No.	Range	Number of Weights	Price
9210	50 lb. to 1 lb.	8	\$155.00
9211	25 " " 1 "	7	105.00
9212	10 " " 1 "	5	59.25
9213	50 " " $\frac{1}{16}$ oz.	16	178.50
9214	25 " " $\frac{1}{16}$ "	15	128.50
9215	10 " " $\frac{1}{16}$ "	13	80.75
9216	4 " " $\frac{1}{16}$ "	11	51.00
9217	1 " " $\frac{1}{16}$ "	9	31.00

Single weights similar to the preceding as follows :

No.	Weight	Price	No.	Weight	Price
9220	50 lb.	\$50.00	9229	8 oz.	\$6.00
9221	25 "	32.00	9230	4 "	4.75
9222	20 "	29.00	9231	2 "	4.00
9223	10 "	18.00	9232	1 "	3.00
9224	5 "	13.75	9233	$\frac{1}{2}$ oz.	2.75
9225	4 "	12.00	9234	$\frac{1}{4}$ "	2.75
9226	3 "	11.00	9235	$\frac{1}{8}$ "	2.50
9227	2 "	10.00	9236	$\frac{1}{16}$ "	2.50
9228	1 "	7.50	9237	$\frac{1}{32}$ "	2.25

**9228 and Case**

One piece, one pound gold-plated weight in case.

No. 9238. A one piece gold-plated precision weight in chamois lined brass case. Price, \$8.00

GRAIN WEIGHTS

In these sets the weights less than 20 grains are made of platinum.

No.	Range		Number of Weights	Price
9240	10000 grains to	10 grains	13	\$45.00
9241	10000 " "	$\frac{1}{10}$ grain	21	50.00
9242	5000 " "	10 grains	12	38.00
9243	5000 " "	$\frac{1}{10}$ grain	20	41.00
9244	1000 " "	10 grains	9	19.25
9245	1000 " "	1 grain	13	23.00
9246	1000 " "	$\frac{1}{10}$ "	17	25.85
9247	1000 " "	$\frac{1}{100}$ "	21	32.50
9248	1000 " "	$\frac{1}{1000}$ "	25	34.00
9249	100 " "	$\frac{1}{10}$ "	13	14.85
9250	100 " "	$\frac{1}{100}$ "	17	13.75
9251	10 " "	$\frac{1}{10}$ "	9	7.50
9255	10 " "	$\frac{1}{100}$ "	13	8.55
9256	10 " "	$\frac{1}{1000}$ "	17	9.45

Prices for single weights from the above sets given on application.

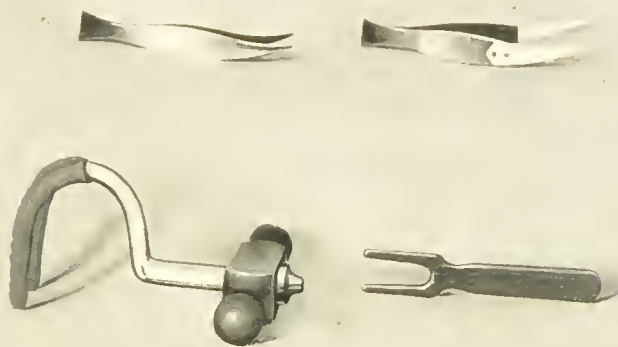
NOTE.—Platinum plated weights, prices on application.



TROY WEIGHTS

No.		Range	Number of Weights	Price
9280	One	500 oz. to 1 pwt.	17	\$146.25
9281	Two	200 " " 1 "	16	113.25
9282	One	200 " " 1 "	15	91.25
9283	Two	100 " " 1 "	15	74.25
9284	One	100 " " 1 "	14	69.25
9285	One	50 " " 1 "	13	54.25
9286	Two	20 " " 1 "	12	45.25
9287	One	20 " " 1 "	12	40.00
9288	One	12 " " 1 "	10	35.00
9290	One	10 " " 1 "	10	31.00
9291	One	5 " " 1 "	9	24.00
9292	Two	2 " " 1 "	8	18.50
9293	One	2 " " 1 "	7	15.50
9294	One	1 " " 1 "	6	12.50

Prices for single weights similar to those in the preceding sets given on application.



8992
8994

8990
8996

FORCEPS AND FORKS

No.		Price
8990	Ivory tipped brass forceps for weights, each,	\$0.75
8992	Brass forceps for weights, each, . . . . .	.25
8994	Brass weight hook, chamois covered, mahogany handle each,	1.50
8996	Hardwood weight fork, each, . . . . .	.30

BRASS TEST WEIGHTS

These brass weights are finished and lacquered, and have the denomination engraved on the screw knob. They are used by the sealer in connection with the portable balance or in any case where an accurate set of weights is desired. *Adjustment is made to the degree of precision and according to specifications required by the United States Government and must not be confounded with lead-filled brass-cased weights often found in use.* The weights are finished all around and on the bottoms. The sets are fitted in a polished box with a handle and hinged cover.



9303

AVOIRDUPOIS WEIGHTS

No.	Range	Number of Weights	Price
9297	50 lb. to 1 lb.	8	\$95.25
9298	25 " " 1 "	7	60.25
9299	10 " " 1 "	5	29.75
9300	50 " " $\frac{1}{16}$ oz.	16	102.55
9301	25 " " $\frac{1}{16}$ "	15	65.00
9302	10 " " $\frac{1}{16}$ "	13	36.00
9303	4 " " $\frac{1}{16}$ "	11	15.00
9304	1 " " $\frac{1}{16}$ "	9	10.50
9305	Two 2 " " $\frac{1}{16}$ "	11	14.50

NOTE.—Gold-plated Screw Knob Weights, add 20 ¢ to above list prices.

Nickel-plated Screw Knob Weights, add 15 ¢ to above list prices.

Single weights similar to the preceding :

No.	Weight	Price	No.	Weight	Price
9307	50 lb.	\$35.00	9316	8 oz.	\$2.00
9308	25 "	24.00	9317	4 "	1.50
9309	20 "	22.00	9318	2 "	1.25
9310	10 "	15.00	9319	1 "	1.00
9311	5 "	6.50	9320	$\frac{1}{2}$ "	.50
9312	4 "	4.00	9321	$\frac{1}{4}$ "	.40
9313	3 "	3.50	9322	$\frac{1}{8}$ "	.40
9314	2 "	3.00	9323	$\frac{1}{16}$ "	.40
9315	1 "	2.25			

METRIC WEIGHTS

No.	Range	Number of Weights	Price
9325	One 20 kilograms to 1 kilogram	6	\$84.00
9326	One 10 " " 1 "	5	51.00
9327	One 5 " " 1 "	4	28.00
9328	One 20 " " 1 gram	18	95.00
9329	One 10 " " 1 "	17	60.00
9330	One 5 " " 1 "	16	39.00
9331	One 1 kilogram " 1 "	13	14.00
9332	One 500 grams " 1 "	12	12.00
9333	One 200 " " 1 "	10	9.00
9334	One 100 " " 1 "	9	6.00
9335	One 50 " " 1 "	8	4.25
9336	One 20 " " 1 "	7	3.50
9337	Two 20 " " 1 "	7	3.50
9338	One 10 " " 1 "	5	3.00

NOTE.—When sets are desired containing weights less than one gram, any of these weights may be combined with any of the sets Nos. 9260 or 9261, or Nos. 9484 or 9485.

Single weights similar to the above as follows :

No.	Weight	Price	No.	Weight	Price
9340	20 kilograms	\$33.00	9348	200 grams	\$2.25
9341	10 "	23.00	9349	100 "	1.75
9342	5 "	16.00	9350	50 "	1.50
9343	4 "	13.50	9351	20 "	.75
9344	3 "	8.50	9352	10 "	.50
9345	2 "	4.50	9353	5 "	.40
9346	1 kilogram	3.00	9354	2 "	.40
9347	500 grams	2.50	9355	1 gram	.40

NOTE.—Gold-plated screw knob weights, add 20% to the above list prices.
Nickel-plated screw knob weights, add 15% to above list prices.



TROY WEIGHTS

No.	Range			Number of Weights	Price
9380	One	500	oz. to 1 pwt.	17	\$81.00
9381	Two	200	" " 1 "	16	61.00
9382	One	200	" " 1 "	15	43.50
9383	Two	100	" " 1 "	15	33.50
9384	One	100	" " 1 "	14	25.50
9385	One	50	" " 1 "	13	17.75
9386	Two	20	" " 1 "	12	15.00
9387	One	20	" " 1 "	12	15.00
9388	One	12	" " 1 "	11	14.50
9389	One	10	" " 1 "	10	12.01
9390	One	5	" " 1 "	9	9.50
9391	Two	2	" " 1 "	8	7.50
9392	One	2	" " 1 "	7	7.00
9393	One	1	" " 1 "	6	5.50

Prices of single weights from the sets listed will be given on application.

NOTE.—Gold-plated screw knob weights, add 20¢ to the above list prices.

Nickel-plated screw knob weights, add 15¢ to above list prices.

FRACTIONAL ALUMINUM GRAM WEIGHTS

No.		Price
9484	Set of weights from 500 milligrams to 1 milligram (13 pieces),	\$2.25
9485	Set of weights from 500 milligrams to $\frac{1}{10}$ milligram (17 pieces),	3.00

Single weights similar to the preceding:

No.	Weight	Price	No.	Weight	Price
9487	500 milligrams	\$0.30	9493	5 milligrams	\$0.10
9488	200 "	.25	9494	2 "	.10
9489	100 "	.20	9495	1 milligram	.10
9490	50 "	.15	9496	$\frac{5}{10}$ "	.30
9491	20 "	.15	9497	$\frac{2}{10}$ "	.30
9492	10 "	.10		$\frac{1}{10}$ "	.30

GRAIN WEIGHTS

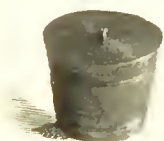
In these sets the weights less than 20 grains are made of aluminum.

No.	Range	Number of Weights	Price
9360	10000 grains to 10 grains	13	\$17.00
9361	10000 " " $\frac{1}{10}$ grain	21	19.00
9362	5000 " " 10 grains	12	11.00
9363	5000 " " $\frac{1}{10}$ grain	20	13.00
9364	1000 " " 10 grains	9	6.00
9365	1000 " " 1 grain	13	7.00
9366	1000 " " $\frac{1}{10}$ "	17	9.50
9367	1000 " " $\frac{1}{100}$ "	21	10.50
9368	1000 " " $\frac{1}{1000}$ "	25	11.00
9369	100 " " $\frac{1}{10}$ "	13	7.00
9370	100 " " $\frac{1}{100}$ "	17	8.00
9371	10 " " $\frac{1}{10}$ "	9	3.00
9372	10 " " $\frac{1}{100}$ "	13	3.50
9373	10 " " $\frac{1}{1000}$ "	17	4.00

Prices of single weights from the set listed above on application.

NOTE.—Gold-plated screw knob weights, add 20% to the above list prices.
Nickel-plated screw knob weights, add 15% to above list prices.

CUP WEIGHTS



These nested cup weights form a very convenient and compact set for traveling inspectors. They are made of solid bronze, the outside of the weights being polished, accurately adjusted.

No. 9400. Avoirdupois nested cup weights from 4 lbs. to $\frac{1}{4}$ oz. Price, \$12.50

No. 9401. Avoirdupois nested cup weights from 4 lbs. to $\frac{1}{4}$ oz. in hand-sewed sole leather carrying case with hinged cover and shoulder strap. Price, \$15.50

No. 9403. Troy nested cup weights from 64 ozs. to $\frac{1}{4}$ oz. Price, \$12.50

No. 9404. Troy nested cup weights from 64 ozs. to $\frac{1}{4}$ oz. in hand-sewed sole leather carrying case with hinged cover and shoulder strap. Price, \$15.50

SUSPENDED PLATFORM WEIGHT

No. 9405. This platform is very serviceable in testing spring scales, steel yards, etc., especially where no hanger weights are available. The platform is iron braced and with the suspension chains and hook weighs exactly 10 lbs.

Price, \$9.00

No. 9406. Similar to No. 9405, but weighing 25 lbs.

Price, \$12.00



9398

INSPECTORS' TEST SET

No. 9398. This set of 13 gold-plated precision weights, consisting of 1lb., 1lb., 1lb., 8, 4, 3, 2, 1, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$ oz., are fitted together with weight lifter in a handsome velvet-lined leather case, having handle and lock and key. The larger weights are cupped to economize on space.

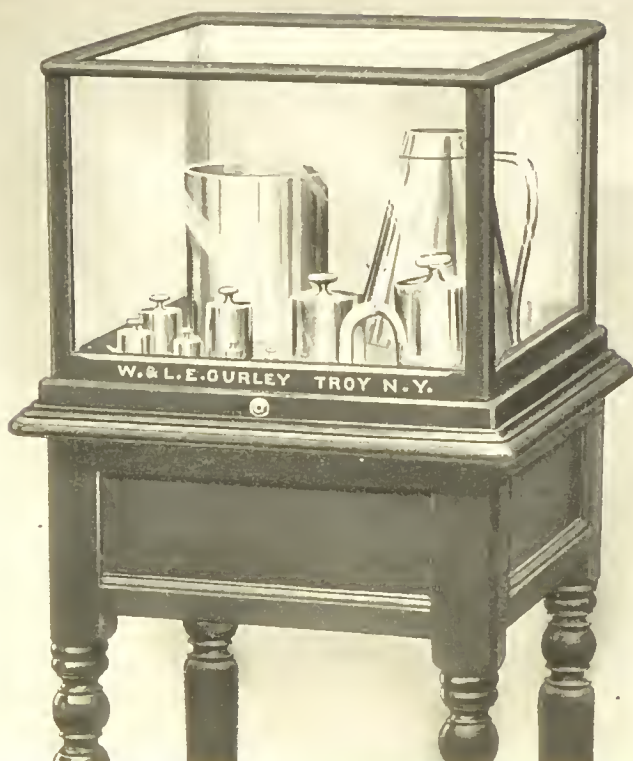
Price, \$35.00



9407 (open)

MERCHANTS' TEST SETS

These test sets are designed for the use of merchants who wish to have accurate as well as handsome test weights and measures with which to compare their own trade weights and measures or test their balances and scales. Full instructions accompany each set. A handsome engraved and framed certificate and guarantee is furnished with each set. When desired, the weights and measures of these sets may be sent to the Bureau of Standards or to any State Department of Weights and Measures for verification or stamping, the cost for which, when there is any, being borne by the purchaser.



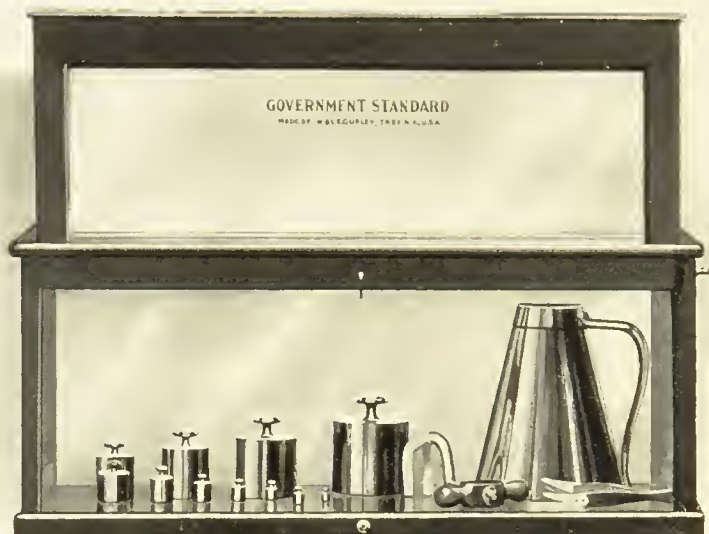
9407 (closed)

MERCHANTS' TEST SETS

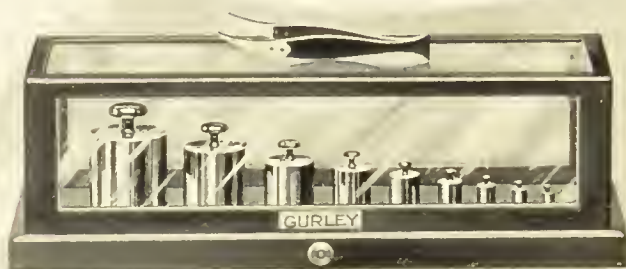
No. 9407. Merchants' Test Set. In this set the hinged glass and mahogany cover is provided with a lock. The case is mounted on a solid mahogany table and is fitted with the following standards: one-piece gold-plated bronze precision weights from four pounds to one-sixteenth ounce; one standard liquid quart; one standard aluminum dry quart. Price, including chamois covered fork and pincettes, \$95.00

No. 9408. Test set similar to No. 9407, but with gold-plated bronze screw knob precision weights.

Price, \$57.00



9411



9415

MERCHANTS' TEST SETS (CONTINUED)

No. 9409. Test Set, similar to No. 9407, but with nickel-plated bronze screw knob precision weights.

Price, \$55.00

No. 9410. Test Set, similar to No. 9407, but with lacquered bronze precision weights. Price, . . . \$53.00

No. 9411. Test Set. In this set the standards are fitted in a glass and mahogany sliding front case. The case is provided with brackets and may be attached to the wall or may be used as a desk or counter set. A standard aluminum dry quart measure with a ring on the inside showing a liquid quart, and a set of one-piece gold-plated bronze precision weights are furnished.

Price, including chamois covered hook and pincettes, \$60.00

No. 9412. Test Set, similar to No. 9411, but with gold-plated bronze screw knob weights. Price, . . . \$33.00

No. 9413. Test Set, similar to No. 9411, but with nickel-plated bronze screw knob precision weights.

Price, \$32.00

No. 9414. Test Set, similar to No. 9411, but with lacquered bronze screw knob precision weights.

Price, \$30.00

No. 9415. Merchants' Test Set. In this set the standards are fitted in a case with a hinged glass and mahogany cover. The set consists of eleven one-piece gold-plated bronze precision weights from four pounds to one-sixteenth ounce.

Price, including pincettes, \$40.00

No. 9416. Test Set, similar to No. 9415, but with gold-plated bronze screw knob precision weights.

Price, \$26.00

No. 9417. Test Set, similar to No. 9415, but with nickel-plated bronze screw knob precision weights.

Price, \$23.00

No. 9418. Test Set, similar to No. 9415, but with lacquered bronze screw knob precision weights.

Price, \$19.00



9420

STEEL TEST GRIP WEIGHTS

These bright nickel-plated weights are made of selected steel with a grip handle screwed in. They are a very convenient and practical test weight, especially for secondary standards to be carried around by the sealer. They are adjusted to the degree of precision required by the United States Government.

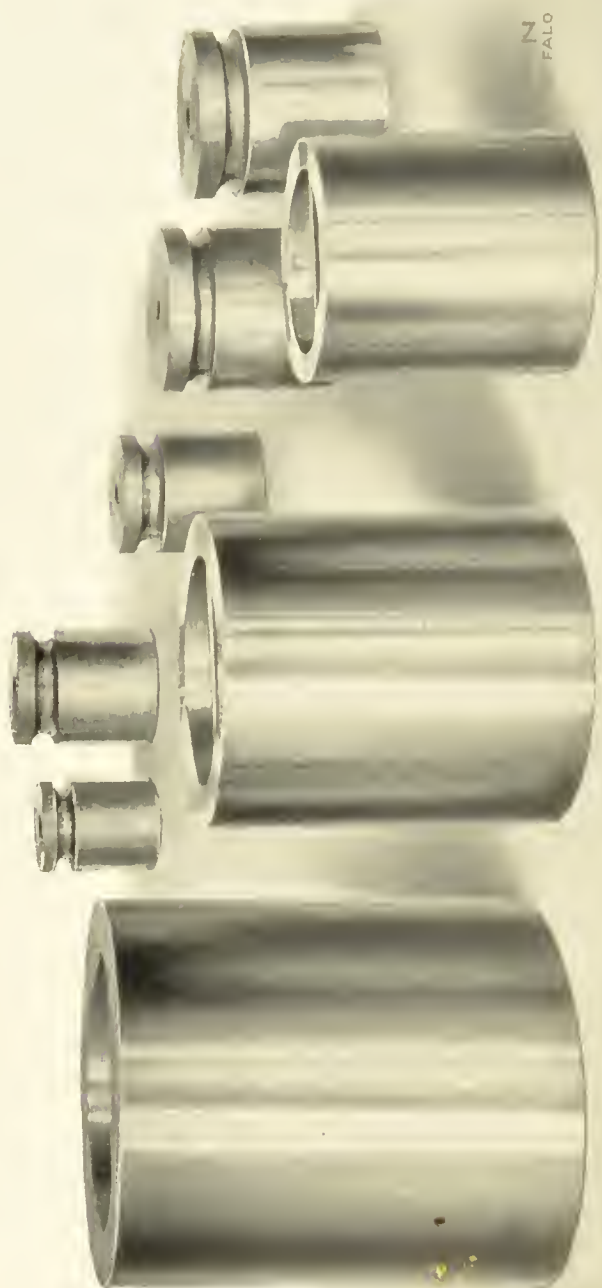
No.		Price
9419	Set of avoirdupois weights as follows : 25, 10, 5 lb., .	\$12.25
9420	Set of avoirdupois weights as follows : 50, 25, 20, 10, 5 lb.,	22.00
9421	Set of avoirdupois weights as follows : 50, 25, 10, 5, 5, 2, 2, 1 lb.,	27.50
9422	Set of metric weights as follows : 20, 10, 5, 2, 2, 1 kg., .	24.50
9423	Set of metric weights as follows : 20, 10, 5 kg.,	16.75
9424	Set of Troy weights as follows : 500, 200, 100, 100, 50 oz.,	20.50
9425	Set of Troy weights as follows : 500, 200, 100, 100, 50, 20, 20, 10 oz.,	25.00

Single weights similar to the above :

No.	Weight	Price	No.	Weight	Price
9428	50 lb.	\$7.50	9441	3 kilograms	\$3.25
9429	25 "	6.00	9442	2 "	3.00
9430	20 "	5.75	9443	1 kilogram	2.25
9431	10 "	3.50	9444	500 oz. Troy	7.00
9432	5 "	3.00	9445	300 " "	5.75
9433	4 "	2.75	9446	200 " "	4.50
9434	3 "	2.50	9447	100 " "	3.50
9435	2 "	2.00	9448	50 " "	2.75
9436	1 "	1.50	9449	40 " "	2.75
9437	20 kilograms	7.50	9450	30 " "	2.25
9438	10 "	6.00	9451	20 " "	2.00
9439	5 "	4.00	9452	10 " "	1.00
9440	4 "	3.50			

STEEL TEST WEIGHTS**NATIONAL BUREAU OF STANDARDS DESIGN**

These nickel-plated test weights are made of selected steel, carefully turned. The top is cupped, with the handle passing through the cup. As there are no projecting parts, the weights may be easily stacked. The adjustment is made by means of a brass plug which is driven into the



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9453

adjusting hole and the seal affixed. The distinctive feature of these weights is that there are no screwed parts, and after once being sealed they cannot be altered without seriously marring the outside or destroying the seal. These weights are made according to the latest designs and specifications of the National Bureau of Standards. They are accurately adjusted in conformity with the Government requirements.

No.		Price
9453	Avoirdupois set as follows: 50, 25, 10, 5, 5, 2, 2, 1 lb.,	\$40.00
9454	Metric set as follows: 20, 10, 5, 2, 2, 1 kg.,	35.00
9455	Troy set as follows: 500, 200, 100, 100, 50, 20, 20, 10 oz.,	40.00

Single weights similar to the above, prices on application.

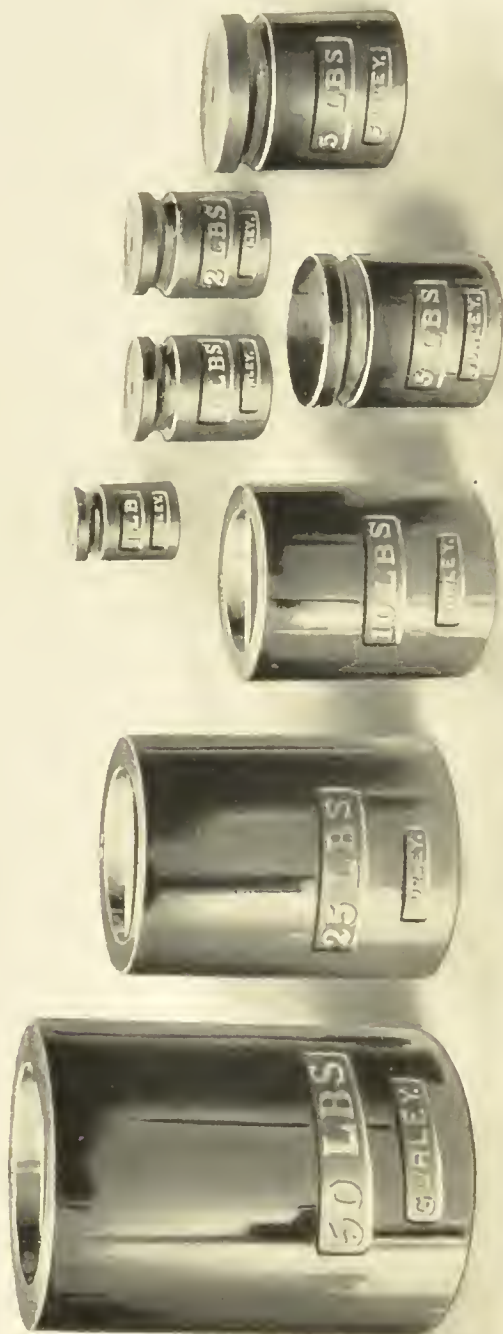
IRON TEST WEIGHTS
NATIONAL BUREAU OF STANDARDS FORM

(For illustration see following page.)

These weights are of the same form and method of adjustment as those described on page 57, but are made of cast iron with steel handles. They are finished with two coats of japan lacquer baked on. They are adjusted to the degree of precision required by the Government.

No.		Price
9510	Set as follows: 50, 25, 10, 5, 5, 2, 2, 1 lb., . . .	\$21.00
9511	Set as follows: 20, 10, 5, 2, 2, 1 kg.,	21.00

Single weights, prices on application.



9510

STEEL HANGER TEST WEIGHTS

These bright nickel-plated weights are made of selected steel with a grip handle screwed in. They are a very convenient and practical test weight, especially for secondary standards to be carried around by the sealer. They are adjusted to the degree of precision required by the United States Government.



No.		Price
9530	Set of avoirdupois weights as follows : 50, 25, 20, 10, 5 lb.,	\$22.00
	Set of avoirdupois weights as follows : 25, 10, 5 lb., . . .	13.00
9531	Set of avoirdupois weights as follows : 50, 25, 10, 5, 5, 2, 2, 1 lb.,	27.50
9532	Set of metric weights as follows : 20, 10, 5, 2, 2, 1 kg., . . .	24.50
9533	Set of metric weights as follows : 20, 10, 5 kg., . . .	16.75
9534	Set of Troy weights as follows : 500, 200, 100, 100, 50 oz.,	20.50
9535	Set of Troy weights as follows : 500, 200, 100, 100, 50, 20, 20, 10 oz.,	25.00

Single weights similar to the above :

Weight	Price	Weight	Price
50 lb.	\$7.50	3 kilograms	\$3.25
25 "	6.00	2 "	3.00
20 "	5.75	1 kilogram	2.25
10 "	3.50	500 oz. Troy	7.00
5 "	3.00	300 " "	5.75
4 "	2.75	200 " "	4.50
3 "	2.50	100 " "	3.50
2 "	2.00	50 " "	2.75
1 "	1.50	40 " "	2.75
20 kilograms	7.50	30 " "	2.25
10 "	6.00	20 " "	2.00
5 "	4.00	10 " "	1.00
4 "	3.50		



9540

FIFTY-POUND TEST WEIGHT

This test weight is square in form. Half a ton to two tons of these weights are required to test large scales, and this amount should be in the possession of every sealer.

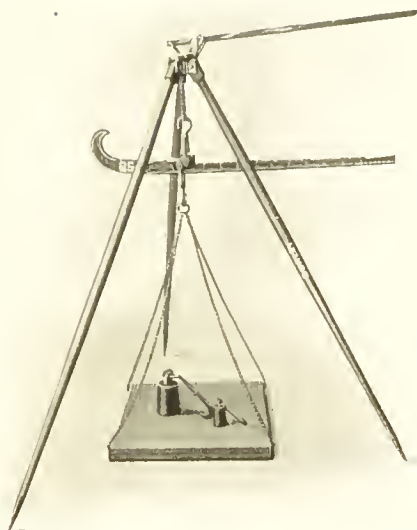
The body of the weight is of cast iron and the handle of steel. The bottom is flat with no screws or projections. The lack of holes on the outside, together with the form, makes the catching of dirt, snow, etc., almost impossible. The weights are painted with aluminum, black or green enamel. They are accurately adjusted.

These weights are, strictly speaking, test weights and should not be confounded with those having cast handles, holes in the bottom or side, loose metal adjustment, insufficient accuracy and other serious defects.

No.	Weight	Price	No.	Weight	Price
9540 Aluminum	50 lb.	\$3.00	9543 Aluminum	20 kilograms	\$3.00
9541 Black	50 "	3.00	9544 Black	20 "	3.00
9542 Green	50 "	3.00	9545 Green	20 "	3.00

SPECIAL WEIGHTS

Weights of any special form, denomination, or material will be made to order and prices will be given on application.



9647

PORTABLE SCALES

The sealer is often called upon to check the weights on ice, coal, baskets of potatoes, etc. He then needs a readily portable scale as light as possible and one that can be set up in any place. As a platform scale must be level to perform properly, it does not answer this purpose.

No. 9647. Portable scale with heavy beam, capacity 250 lbs., platform, box hooks, four poises, tripod with raising lever, weight complete, 26 pounds. Price, . . . \$25.00

No. 9648. Portable scale similar to No. 9647 but with a circular dial spring scale of 250 lbs. capacity instead of the beam. Price, \$29.50

PORTABLE PLATFORM SCALES

(ARMY AND NAVY TYPE)

These scales require two men to handle them, but are convenient where they can be set on a level place for some time.

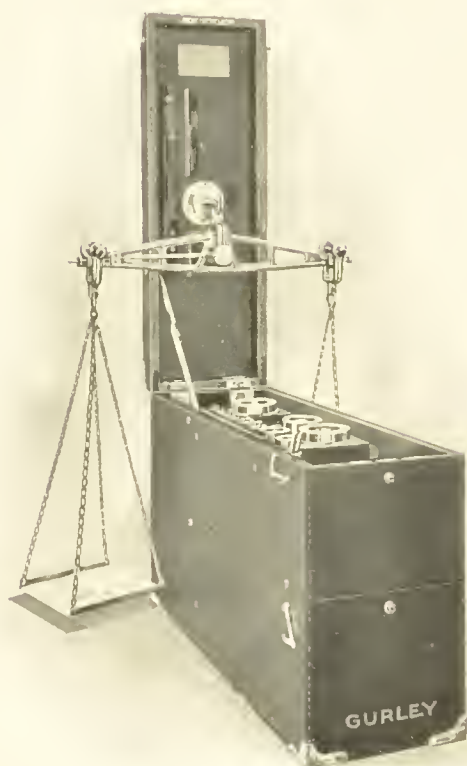
No. 9950. Capacity, 600 lbs., platform, 17 x 22 ½ in.

No. 9953. Capacity, 300 lbs., platform, 13 x 18 ¾ in.

Prices on application.



9554 — Closed



9554 — Upper Part Open

PORTABLE INSPECTION SET

On many tours of inspection an inspector, whether State, or city, or a town sealer, requires only certain pieces of test apparatus, and these should be conveniently and compactly assembled in a carrying case.

The portable sets, listed below, have been designed to meet the above requirements and will be found most convenient, their light weight, particularly, will appeal to the practical sealer.

No. 9554. Portable inspection set.—This set contains a portable balance No. 9560, a set of eleven gold-plated weights, a brass liquid quart measure, aluminum dry quart, pint and half-pint measures with rings indicating the nearest liquid measure, a one ounce glass graduate, a dry measure gauge and a slicker plate.

The case is made of mahogany with six ounce black grain leather covering, hand sewed; the metal trimmings and corners are nickel-plated; hooks and spring locks are provided. The case furnishes sufficient space for small tools, seals, tags, receipt book, etc.

The dimensions are 19x12x6 inches. The weight of the set complete is 26 lbs. Price, \$110.00

No. 9555. Portable inspection set, similar to No. 9554, but with nickel-plated knob weights. Price, . . . \$90.00

No. 9556. Portable inspection set, similar to No. 9555, but with polished mahogany case. Weight of set 20 lbs.

Price, \$80.00

No. 9557. Portable inspection set; this set contains a portable balance (No. 9560), a set of eleven lacquered brass weights (No. 9305), a dry measure gauge, an aluminum quart and pint dry and liquid measure, a slicker plate and a one ounce graduate, all fitted in a polished mahogany case provided with spring lock.

The weight of the set is 17 lbs. Price, . . . \$66.00



9560
PORTABLE BALANCE
 MASSACHUSETTS PATTERN
(Patented.)

No. 9560. This balance has a capacity of ten pounds or four kilograms on each pan. It has been especially designed for sealer's use in going on a tour of inspection from store to store. It folds into a case 19 x 6 x 6 inches, and can be set up on any table or counter ready for use in less than ten seconds. The top of the case is raised, the beam with the attached pans is hung on the hook and the balance is ready for making test weighings. The parts have been so proportioned that it is light without sacrificing rigidity or accuracy. The beam is of aluminum, the other parts of nickel-plated brass. The pans are slightly concave, so that shot or small objects cannot roll off. All parts are finished. The balance was originally designed for the sealers of the State of Massachusetts.

Price, \$35.00

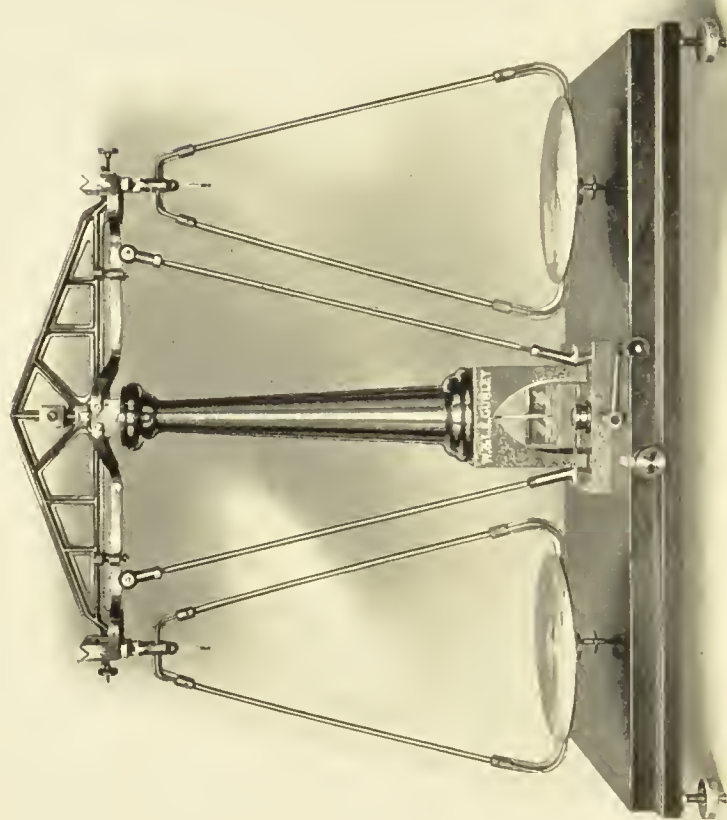


PORTABLE BALANCE

MASSACHUSETTS PATTERN

No. 9562. This balance has a capacity of 8 pounds on each pan. The beam, pans and base are of aluminum, to insure lightness, the weight complete being only $6\frac{3}{4}$ pounds. The pans are $4\frac{1}{2}$ inches in diameter and are provided with a ridge to prevent shot from rolling off. The bearing surfaces are of agate. The interior of the balance may be readily inspected by removing the pans and raising the inside hinged cover. The polished mahogany case is provided with leveling screws, circular level and a carrying handle. The level screws are on the inside of the box, so that when the case is closed no projections occur which are liable to be broken and are always interfering. A spring stop is provided, so that weighings can be quickly and readily made. The balance is very sensitive and specially adapted for sealers' use. The dimensions of the case are approximately 13 x 6 x 6 inches.

Price, \$35.00



9570

LARGE OFFICE BALANCE

No. 9570. This balance has a capacity of fifty pounds or twenty-five kilograms on each pan, with a sensibility of one grain or .06 gram at full load. It is of an exceptionally rigid and stable construction and therefore admirably suited for mints, custom houses, the sealer's office, and in all cases where a large accurate balance is necessary. The beam and parts of the pan hangers are of aluminum, each member being of the ribbed construction, all the other metal parts are of bronze. The planes are of agate and the knife edges of gold-plated hardened steel. The pointer swings over a horizontal ivory scale, back of which is placed a mirror to facilitate the readings. A circular level is placed in front of the scale. The pans are provided with a spring arrestment. The beam arrestment is of the best three-point Mendelejeff type. The balance is highly finished.

Price, \$150.00

No. 9575. Balance similar to 9570, but with enameled iron pillar. Price, \$140.00

NOTE.—Prices for larger balances or of special construction quoted on application.

SMALL OFFICE BALANCE

No. 9590. This short arm aluminum beam balance is made entirely of nonmagnetic material and has agate edges and planes. The capacity of the balance is 500 grams or 16 ounces, with a sensibility of $\frac{1}{10}$ milligram. The beam is graduated its entire length. The finish and workmanship of the balance is the best. The case is made of mahogany with glass top and sliding front. Price, \$95.00

Test, Chemical, and Assay balances of various capacities and sensitiveness. Prices and description on application.

CARRYING CASES

We are prepared to furnish carrying cases of various kinds of well-seasoned wood, metal, or leather. Prices quoted on receipt of specifications.

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9676

OFFICE CASE

No. 9675. This case of well-seasoned oak is of the best material, workmanship, and finish. It is six and one-half feet high, five feet wide, and two and one-quarter feet deep, divided into two compartments, the upper one being designed for holding the large office balance (see page 84), together with shelves for small weights, etc., and the lower one for the dry and the liquid capacity measures and other accessories of the sealer. The upper part has a mirror back and sliding front door, the lower part, panel back and folding doors. Price, \$160.00

NOTE.— Cases of other material and different design made to order. Prices on application.

HAND-CARTS

These hand-carts are well made and nicely painted. The wheels have twelve spokes and are very strong. Where the sealer is not furnished with a wagon, he will find this cart useful in going on his tours of inspection.

No.	Size of Box	Diam. of Wheels	No. of Wheels	Style	Price
9690	22 x 48 in.	42 in.	3	Spring	\$16.00
9691	23 x 40 "	36 "	3	"	14.00
9692	22 x 48 "	42 "	2	Plain	13.50
9693	23 x 40 "	36 "	2	"	11.00
9694	20 x 32 "	30 "	2	"	10.00

BALANCE SHELVES



These shelves can be furnished with wooden, marble, or slate tops, with or without drawers.

Prices on application.

MEASURING FLASKS

These flasks are accurately graduated to contain the named volume at 15° C.



9741

STOPPERED

No.	Volume	Price	No.	Volume	Price
9720	2 liters	\$2.20	9730	2 quarts	\$2.20
9721	1 liter	1.70	9731	1 quart	1.70
9722	$\frac{1}{2}$ "	1.50	9732	1 pint	1.50
9723	$\frac{1}{4}$ "	1.25	9733	$\frac{1}{2}$ "	1.25
9724	200 cc.	1.20	9724	1 gill	1.20
9725	100 "	1.15			
9726	50 "	1.10			

NOT STOPPERED

9740	2 liters	\$1.80	9747	2 quarts	\$1.80
9741	1 liter	1.40	9748	1 quart	1.40
9742	$\frac{1}{2}$ "	1.10	9749	1 pint	1.10
9743	$\frac{1}{4}$ "	.75	9750	$\frac{1}{2}$ "	.75
9744	200 cc.	.70	9751	1 gill	.70
9745	100 "	.65			
9746	50 "	.60			

BURETTES WITH GLASS STOPCOCKS

Tested and certified for precision work.

No.	Divisions	Contents	Price
9760	$\frac{1}{3}$ cc.	100 cc.	\$4.60
9761	$\frac{1}{2}$ "	100 "	4.00
9762	$\frac{1}{10}$ "	50 "	3.75
9763	$\frac{1}{5}$ "	50 "	3.30

BURETTE HOLDER

No. 9765. This holder consists of a stable tripod, nickel-plated steel upright and an adjustable cork-lined clamp.
Price, \$2.25

COPPER FUNNELS

These funnels have seamless bodies. They are required by the sealer to fill measure and milk bottles when testing them.

NICKEL PLATED

No.	Capacity	Price
9773	$\frac{1}{2}$ pint	\$0.70
9774	1 "	.80
9775	1 quart	.90
9776	$\frac{1}{2}$ gallon	1.25
9777	"	2.00

TIN LINED

No.	Capacity	Price
9778	$\frac{1}{2}$ pint	\$0.50
9779	1 "	.70
9780	1 quart	.70
9781	$\frac{1}{2}$ gallon	1.00
9782	1 "	1.75



9761

GRADUATES

These graduates are made to deliver the quantities indicated. They are standard at 15 degrees centigrade and are tested after graduation. The readings are to be made at the bottom of the meniscus.

CONE SHAPED

No.	To Deliver	Price	No.	To Deliver	Price
9790	60 minims	\$0.35	9797	6 ounces	\$0.60
9791	120 "	.40	9798	8 "	.70
9792	½ ounce	.25	9799	12 "	.85
9793	1 "	.30	9800	16 "	1.00
9794	2 "	.35	9801	32 "	1.90
9795	3 "	.40	9802	64 "	3.00
9796	4 "	.50			
9806	5 cc.	.30	9811	120 cc.	.60
9807	10 "	.40	9812	250 "	.85
9808	15 "	.30	9813	500 "	1.30
9809	30 "	.30	9814	1000 "	2.20
9810	60 "	.45			

CONE SHAPED WITH METRIC AND APOTHECARIES' MEASURE

9816	1 dram and 5 cc.	\$0.45	9821	4 oz. and 120 cc.	\$0.80
9817	2 " " 10 "	.60	9822	8 " " 200 "	1.15
9818	½ oz. " 15 "	.40	9823	16 " " 500 "	1.80
9819	1 " " 30 "	.45	9824	32 " " 1000 "	3.00
9820	2 " " 60 "	.55			



CYLINDRICAL GRADUATES

APOTHECARIES'			METRIC		
No.	To Deliver	Price	No.	To Deliver	Price
9830	32 ounces	\$2.75	9836	1000 cc.	\$3.25
9831	16 "	1.60	9837	500 "	1.70
9832	8 "	1.00	9838	250 "	1.35
9833	4 "	.75	9839	100 "	1.00
9834	2 "	.65	9840	50 "	.75
9835	1 "	.55	9841	25 "	.60
			9842	10 "	.52
			9843	5 " in ½ cc.	.65

9844 Cylindrical graduates, 10 x 2 in., graduated in ½ cu. in. Price, \$0.90.



LIQUID CAPACITY MEASURES

NATIONAL BUREAU OF STANDARDS DESIGN

These measures are made according to the designs and specifications of the National Bureau of Standards. They represent the finest and most permanent type of construction. Each measure is provided with a glass "slicker" plate and is carefully adjusted with distilled water, making the necessary corrections for temperature, etc., in strict conformity with the Government Standards and requirements.

No. 9850. Set of measures including the following: 1 gallon, 1/2 gallon, 1 quart, 1 pint, 1/2 pint. Each measure is separately fitted in the carrying case.

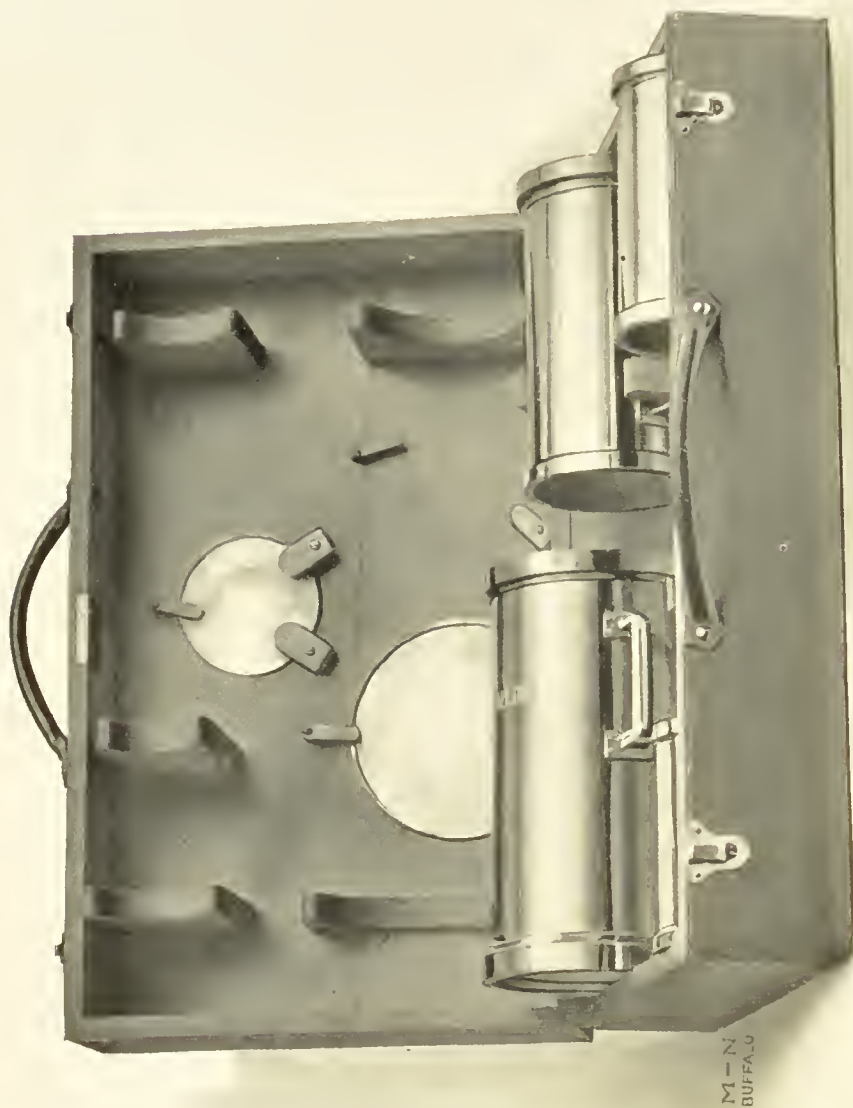
Price, with case, \$75.00

No. 9851. Set of measures including the following: 4 liters, 1 double liter, 1 liter, 1/2 liter, 1 deciliter. Each measure separately fitted in the carrying case.

Price, with case, \$75.00

Single measures similar to the above :

No.	Capacity	Price	No.	Capacity	Price
9855	1 gallon	\$23.00	9861	5 liters	\$25.00
9856	1/2 "	18.00	9862	4 "	23.00
9857	1 quart	15.00	9863	2 "	18.00
9858	1 pint	12.00	9864	1 liter	15.00
9859	1/2 "	7.00	9865	1/2 "	12.00
9860	1 gill	4.50	9866	2 deciliters	7.00
			9867	1 deciliter	4.00



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BUFFALO

9850

LIQUID CAPACITY MEASURES

CYLINDRICAL PATTERN

These measures are similar in form to the design of the National Bureau of Standards, but are of different construction, being provided with a ribbed brass strengthening bottom and a top rim. Every measure is accurately adjusted with distilled water in strict conformity with the Government Standard requirements.

No.		Price
9890	Set of nickel-plated measures (1 gallon, $\frac{1}{2}$ gallon, 1 quart, 1 pint, $\frac{1}{2}$ pint, 1 gill glass graduate). The last four are in a carrying case,	\$36.00
9891	Set of nickel-plated measures (1 quart, 1 pint, $\frac{1}{2}$ pint, 1 gill glass graduate), in a carrying case,	25.00
9892	Set similar to No. 9890, but polished,	33.00
9893	Set similar to No. 9891, but polished,	23.50
9894	Set of nickel-plated measures (4 liters, 2 liters, 1 liter, $\frac{1}{2}$ liter, 1 deciliter glass graduate), the last three in a carrying case,	34.00
9895	Set of nickel-plated measures (1 liter, $\frac{1}{2}$ liter, 1 deciliter glass graduate), in a carrying case,	21.00
9896	Set similar to No. 9894, but polished,	32.00
9897	Set similar to No. 9895, but polished,	19.50

Single measures similar to the above:

NICKEL-PLATED

No.	Capacity	Price
9900	1 gallon	\$9.00
9901	$\frac{1}{2}$ "	8.50
9902	1 quart	7.60
9903	1 pint	6.60
9904	$\frac{1}{2}$ "	6.10
9905	1 gill	5.60
9906	5 liters	11.50
9907	4 "	9.00
9908	2 "	8.60
9909	1 liter	7.60
9910	$\frac{1}{2}$ "	6.60
9911	1 deciliter	5.60

POLISHED

No.	Capacity	Price
9915	1 gallon	\$8.25
9916	$\frac{1}{2}$ "	7.90
9917	1 quart	7.00
9918	1 pint	6.00
9919	$\frac{1}{2}$ "	5.50
9920	1 gill	5.00
9921	5 liters	10.75
9922	4 "	8.25
9923	2 "	8.00
9924	1 liter	7.00
9925	$\frac{1}{2}$ "	6.00
9926	1 deciliter	5.00



LIQUID CAPACITY MEASURES

CONICAL PATTERN

These liquid capacity measures were originally suggested by Mr. D. C. V. Palmer, State Sealer of the Commonwealth of Massachusetts.

The shape of the measures makes them very convenient to handle and at the same time very stable. To avoid any alteration in capacity, the measures are made with ribbed brass bottoms and top strengthening rims. The handles are attached by screws. Each measure is carefully adjusted with distilled water, in strict conformity with the Government Standards and requirements.

No.		Price
9930	Set of nickel-plated measures, 1 gallon, $\frac{1}{2}$ gallon, 1 quart, 1 pint, $\frac{1}{2}$ pint, 1 gill (the last four in a carrying case),	\$38.00
9931	Set similar to No. 9930, but polished,	36.00
9932	Set of nickel-plated measures, 4 liters, 2 liters, 1 liter, $\frac{1}{2}$ liter, 1 deciliter (the last three in a carrying case),	38.00
9933	Set similar to 9932, but polished,	36.00
9934	Set of nickel-plated measures, 1 quart, 1 pint, $\frac{1}{2}$ pint, 1 gill, 2 oz. glass graduate,	27.00
9935	Set similar to No. 9934, but polished,	24.50

Single measures similar to the above :

NICKEL PLATED			POLISHED		
No.	Capacity	Price	No.	Capacity	Price
9940	1 gallon	\$10.75	9952	1 gallon	\$10.00
9941	$\frac{1}{2}$ "	8.60	9953	$\frac{1}{2}$ "	8.00
9942	1 quart	7.60	9954	1 quart	7.00
9943	1 pint	6.60	9955	1 pint	6.00
9944	$\frac{1}{2}$ "	6.10	9956	$\frac{1}{2}$ "	5.50
9945	1 gill	5.60	9957	1 gill	5.00
9946	5 liters	12.75	9958	5 liters	12.00
9947	4 "	10.75	9959	4 "	10.00
9948	2 "	8.60	9960	2 "	8.00
9949	1 liter	7.60	9961	1 liter	7.00
9950	$\frac{1}{2}$ "	6.60	9962	$\frac{1}{2}$ "	6.00
9951	1 deciliter	5.60	9963	1 deciliter	5.00



9930 (See page 97)

LIQUID CAPACITY MEASURES

CONICAL PATTERN

LIGHTER CONSTRUCTION

Each measure is carefully adjusted with distilled water, in strict conformity with the Government Standards and requirements.

No. 9930B. Set of nickel-plated measures, 1 gallon, $\frac{1}{2}$ gallon, 1 quart, 1 pint, $\frac{1}{2}$ pint, 1 gill, 2 ounce graduate (the last five in a carrying case). Price, \$28.00

No. 9965. The same as No. 9930B, but without case and graduate. Price, \$24.00

No. 9931B. Set similar to No. 9930B, but polished. Price, \$27.00

No. 9965B. Set similar to No. 9965, but polished. Price, \$23.00

No. 9966. Set of nickel-plated measures, $\frac{1}{2}$ gallon, 1 quart, 1 pint, $\frac{1}{2}$ pint, 1 gill, 2 ounce graduate (the last five in a case). Price, \$24.00

No. 9966B. Set similar to No. 9966, but without case. Price, \$20.00

No. 9967. Set of nickel-plated measures, 1 quart, 1 pint, $\frac{1}{2}$ pint, 1 gill, 2 ounce graduate, in case. Price, . . . \$23.00

No. 9968. Set of nickel-plated measures, 1 quart, 1 pint, $\frac{1}{2}$ pint, in case. Price, \$20.00

No. 9968B. Set similar to No. 9968, but without case. Price, \$16.50

Single measures similar to the above:

NICKEL PLATED			POLISHED		
No.	Capacity	Price	No.	Capacity	Price
9940B 1	gallon	\$ 9.00	9952B 1	gallon	\$ 8.50
9941B $\frac{1}{2}$	"	7.00	9953B $\frac{1}{2}$	"	6.75
9942B 1	quart	6.00	9954B 1	quart	5.75
9943B 1	pint	5.50	9955B 1	pint	5.25
9944B $\frac{1}{2}$	"	5.00	9956B $\frac{1}{2}$	"	4.75
9945B 1	gill	4.50	9957B 1	gill	4.25
9946B 5	liters	11.00	9958B 5	liters	10.50
9947B 4	"	9.00	9959B 4	"	8.50
9948B 2	"	7.00	9960B 2	"	6.75
9949B 1	liter	6.20	9961B 1	liter	5.90
9950B $\frac{1}{2}$	"	5.60	9962B $\frac{1}{2}$	"	5.25
9951B 1	deciliter	4.50	9963B 1	deciliter	4.25



10000



DRY CAPACITY MEASURES

NATIONAL BUREAU OF STANDARDS DESIGN

These measures are made according to the designs and specifications of the National Bureau of Standards, and represent the finest and most permanent type of construction. They are made of heavy brass tubing with extra rigid base and rim. Adjustment is made with distilled water, making the necessary corrections. These measures were designed for State Standards.

No.		Price
9970	Set of measures, each with a "slicker" or cover plate of glass, $\frac{1}{2}$ bushel, 1 peck, $\frac{1}{2}$ peck, $\frac{1}{4}$ peck, 1 quart,	\$175.00
9971	Set of metric measures similar to No. 9970, 1 dekaliter, $\frac{1}{2}$ dekaliter, 1 double liter, 1 liter, $\frac{1}{2}$ liter,	175.00

Single measures similar to the preceding :

No.	Capacity	Price	No.	Capacity	Price
9975	$\frac{1}{2}$ bushel	\$60.00	9981	2 dekaliters	\$60.00
9976	1 peck	48.00	9982	1 dekaliter	48.00
9977	$\frac{1}{2}$ "	37.00	9983	$\frac{1}{2}$ "	37.00
9978	$\frac{1}{4}$ "	23.00	9984	2 liters	23.00
9979	1 quart	15.00	9985	1 liter	15.00
9980	1 pint	10.00	9986	$\frac{1}{2}$ "	10.00

DRY CAPACITY MEASURES

These measures are punched from one piece of metal and are made with a ribbed brass strengthening bottom and a top rim. They are very carefully adjusted by weighing with distilled water, applying the necessary temperature corrections. They are light but rigid and the handles are so attached that the measures may be nested.

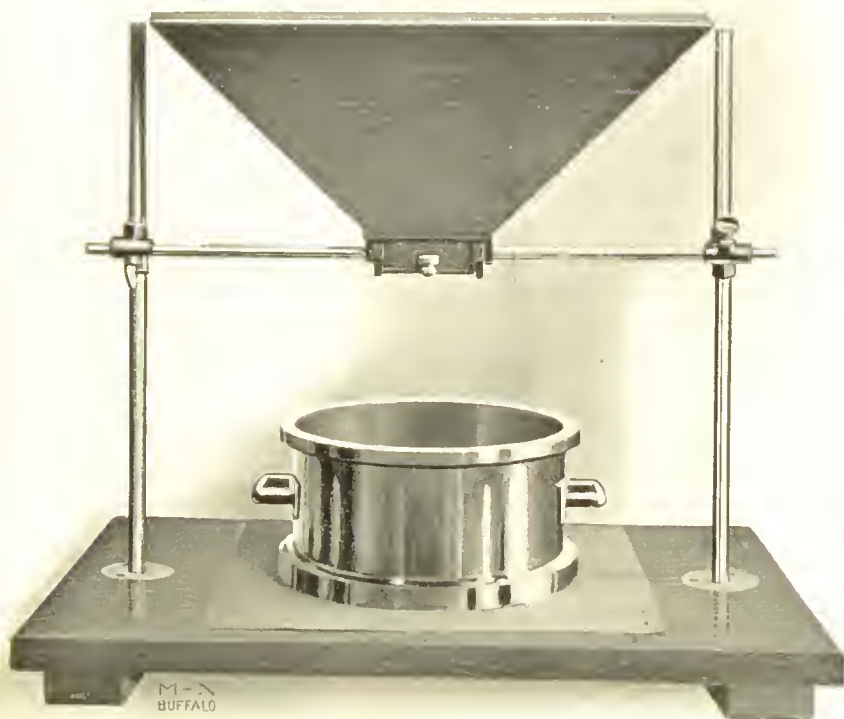
No.		Price
10000	Set of nickel-plated measures as follows: $\frac{1}{2}$ bushel, 1 peck, $\frac{1}{2}$ peck, 1 quart, 1 pint, $\frac{1}{2}$ pint,	\$55.00
10001	Set of nickel-plated measures as follows: 1 dekaliter, $\frac{1}{2}$ dekaliter, 1 liter, $\frac{1}{2}$ liter, 2 deciliters,	33.00
10002	Set similar to 10000, but polished,	50.00
10003	Set similar to 10001, but polished,	30.00



10000

Single measures similar to the above :

NICKEL-PLATED			POLISHED		
No.	Capacity	Price	No.	Capacity	Price
10006	$\frac{1}{2}$ bushel	\$13.50	10020	$\frac{1}{2}$ bushel	\$12.00
10007	1 peck	12.75	10021	1 peck	11.50
10008	$\frac{1}{2}$ "	11.50	10022	$\frac{1}{2}$ "	10.50
10009	1 quart	7.50	10023	1 quart	7.50
10010	1 pint	6.60	10024	1 pint	6.00
10011	$\frac{1}{2}$ "	6.10	10025	$\frac{1}{2}$ "	5.50
10012	2 dekaliters	13.50	10026	2 dekaliters	12.00
10013	1 dekaliter	12.75	10027	1 dekaliter	11.50
10014	$\frac{1}{2}$ "	11.50	10028	$\frac{1}{2}$ "	10.50
10015	1 liter	7.60	10029	1 liter	7.50
10016	$\frac{1}{2}$ "	6.60	10030	$\frac{1}{2}$ "	6.00
10017	2 deciliters	6.10	10031	2 deciliters	5.50



10040

HOPPER FUNNEL FOR DRY MEASURES

A very efficient method of checking dry measures is to place the standard measure under a special hopper funnel and allow grain to flow into the measure until it is striking full. Then into the empty hopper funnel pour the measured grain, placing the measure to be tested under the funnel, allow the grain to flow into it. If the measure under test is correct it will be striking full also.

This hopper funnel is constructed of hardwood with a brass cut off. It is adjustable in height and mounted on a wooden base.

No.
10040

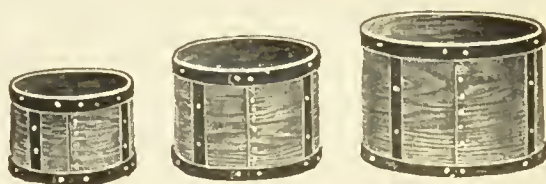
Price
\$25.00



ALUMINUM DRY OR BERRY MEASURES

These measures are light and convenient to carry. The measures may be nested. They are accurately adjusted with distilled water.

No.	Size of Measure	Price
10045	One quart measure	\$6.00
10046	One pint "	5.00
10049	One-half pint "	4.50
10047	One liter "	6.00
10048	One-half liter "	5.00



WOODEN DRY CAPACITY MEASURES

No. 10035. These are the best sealed, iron-bound, and varnished wooden measures. They are a good working set for the sealer. The set includes $\frac{1}{2}$ bushel, 1 peck, $\frac{1}{2}$ peck, $\frac{1}{4}$ peck, and 1 quart.

Price per set, \$2.00

COAL OR COKE MEASURES

No. 10038. Two bushel measure. This measure is a dove-tailed box having the capacity or contents of two bushels. It is very carefully and accurately made of well dried selected wood. Handles are provided. Price, \$3.75

CORNOMETERS OR GRAIN TESTING SCALES

No. 10055. This instrument is so graduated that the beam indicates the weight of the grain per bushel when the quart cup or bucket, filled with grain, is balanced by the sliding counterpoise. It is accurately adjusted. The bucket and funnel are nickel-plated, the other parts are highly finished. Fitted in a wooden case 12 x 6 x 5 inches. Price, . \$21.00

No. 10056. Similar to No. 10055, but with an attachment which does not necessitate the removal of the cup when filling or emptying. Price, \$25.00

No. 10057. Similar to No. 10055, but with liter bucket indicating weights per hectoliter. Price, \$21.00

No. 10058. Similar to No. 10056, but metric.
Price, \$25.00

HAND GRAIN TESTERS

These testers are highly finished and accurately adjusted, but have no funnel and no carrying case.

No.	Size of Cup	Price	No.	Size of Cup	Price
10060	½ pint	\$10.00	10064	½ liter	\$10.50
10061	1 “	10.50	10065	1 “	11.00
10062	1 quart	11.00	10066	2 liters	12.00
10063	2 quarts	12.00			

Other styles made to order and prices given upon application.

CRAYONS

No.	Description	Price
10120	Faber's Round, Wax Crayon Pencils, box of six, . .	\$0.75
10123	Venetian Crayons, Dark Red, per dozen, . . . .	.70
10124	Hexagon Crayons, Black, per dozen, . . . . .	.65



9870

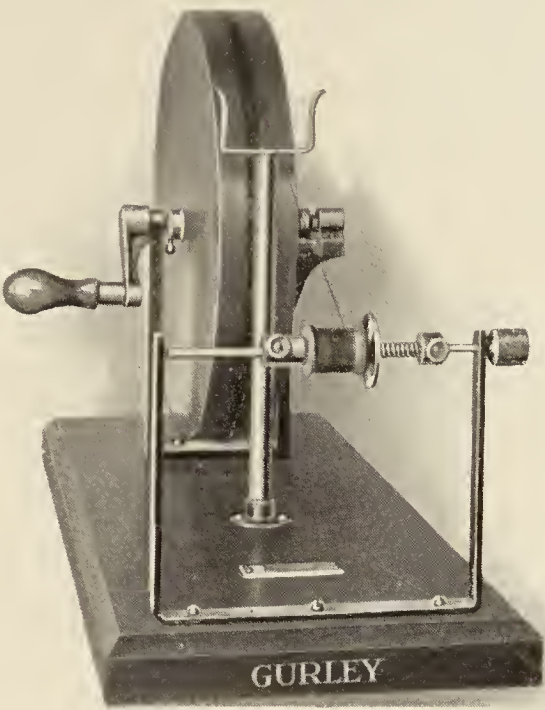
LARGE BUCKET MEASURE

No. 9870. This five-gallon measure is made of heavy copper with ribbed brass bottom. It is provided with a pouring spout, faucet and a heavy steel handle. The measure is accurately adjusted with distilled water, the necessary temperature corrections being made.

Price, \$35.00

No. 9871. This measure is similar to No. 10085 in construction, but has a capacity of 20 liters. Price, . \$35.00

No. 9872. Five gallon measure, Bureau of Standards form. Price, \$85.00



10068

MEASURING REELS

No. 10068. In a number of localities the sealer is called on to measure the amount of thread on spools, twine, etc. This is done by weighing a known length and then from the weight of the whole the total amount is calculated. Or, another method is to measure the total length directly by winding on a standard size reel. The circumference of this reel is exactly one yard; a counter gives the number of turns and then the exact number of yards are indicated. A spring-catch holds the ends of the thread. The tension is adjustable. Price, \$45.00

GAUGE FOR DRY MEASURES

No. 10070. This gauge is in the form of a three-fold brass rule which is marked with the diameters and the corresponding depths of the ordinary standard dry measures. It is a very convenient tool, by which the sealer can ascertain in a moment whether a measure is far out or not. Price, \$1.50

No. 10071. This gauge is in the form of a four-fold brass tipped wooden rule, having the diameters and corresponding depths of the ordinary United States standard dry measures indicated thereon. Price, \$0.45

STRIKING STICK

No. 10075. Striking stick of nickel-plated brass, with mahogany handle. It is essential for the sealer in ascertaining strike measure. Price, \$1.00

"SLICKER" PLATES

No.		Price
10076	Large glass "slicker" or cover plate for $\frac{1}{2}$ bushel or 1 peck measure,	\$2.00
10077	Medium glass "slicker" plate for $\frac{1}{2}$ peck measure,	1.00
10078	Small glass "slicker" plate for small measures, . . . . .	.75



10105

POCKET SPIRIT LEVELS

FRENCH MAKE

No.	Size	Price	No.	Size	Price
10100	3 in.	\$0.50	10102	9 in.	\$1.50
10101	6 "	1.00	10103	12 "	2.00

ADJUSTABLE AND IN WOODEN CASE

No.	Size	Price	No.	Size	Price
10105	3 in.	\$3.00	10106	10 in.	\$4.00

STEEL LETTERS AND FIGURES

These letters and figures are put up in a wooden case. They are made of the best steel, with properly-shaped letters. They are hardened and the temper carefully drawn, so that they may be used on all metals.

No.				Price
10145	Set of Figures,	$\frac{1}{8}$ in.	Price per set,	\$ 0.90
10146	" " "	$\frac{1}{4}$ "	" " "	1.50
10147	" " "	$\frac{1}{2}$ "	" " "	4.50
10148	" " Alphabet,	$\frac{1}{8}$ "	" " "	2.70
10149	" " "	$\frac{1}{4}$ "	" " "	4.50
10150	" " "	$\frac{1}{2}$ "	" " "	13.50
10151	Single Letter or Figure,	$\frac{1}{8}$ in.,	. . . . .	.15
10152	" " " "	$\frac{1}{4}$ "	. . . . .	.20
10153	" " " "	$\frac{1}{2}$ "	. . . . .	.50

DIES FOR MEASURES AND WEIGHTS

DEEP CUT AND PROPERLY TEMPERED

No.		Price
10155	$\frac{1}{2}$ in. die with the letters "CD," for stamping condemned measures and weights,	\$1.50
10155B	$\frac{3}{8}$ in. die with letters "CD,"	1.20
10156	$\frac{1}{8}$ in. die with the letters "CD," for stamping small measures and weights, . . . . .	.75
10157	$\frac{1}{2}$ in. die with the word "CONDEMNED," for stamping large measures and weights,	5.00
10157B	$\frac{3}{8}$ in. die with word "CONDEMNED,"	3.75
10158	$\frac{1}{8}$ in. die with the word "CONDEMNED," for stamping small measures and weights,	1.50
10159	$\frac{1}{2}$ in. die with the initial of the county, city, or town, and the year; thus "C 06." These are used for stamping sealed weights and measures,	2.25
10159B	$\frac{3}{8}$ in. die with three letters or figures,	1.80
10160	$\frac{1}{8}$ in. die, similar to No. 10159, used in sealing small weights and measures, . . . . .	.95
10161	$\frac{1}{2}$ in. die, similar to No. 10159, but having two letters; thus, "J. C. 06,"	3.00
10161B	$\frac{3}{8}$ in. die, similar to No. 10159, but with four letters or figures,	2.50
10162	$\frac{1}{8}$ in. die, similar to No. 10161,	1.00

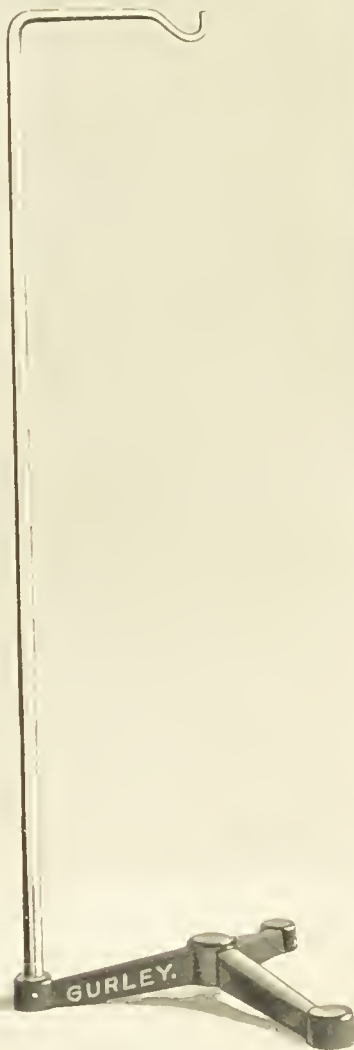
SCALE HOOK

No. 10092. This scale hook may be attached to the wall, to a pillar, or to the back end of a wagon. Price, . . \$1.50

SEALERS' CASE TRUCK

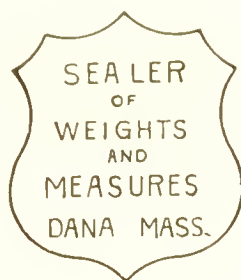
No. 10094. The sealer often has to handle cases of milk bottles and other heavy boxes. This small six-wheel rocking truck is specially adapted for the purpose.

Price on application.



STAND FOR SPRING BALANCES

No. 10090. In testing spring balances it is very desirable to have a hooked stand of sufficient strength and stability.
Into one leg of the tripod base is fastened a nickel-plated steel rod, 3½ feet high, terminating with a hook at its upper end. Price, \$5.00
No. 10091. Stand similar to the above, but with heavier base and having a height of 6 feet. Price, \$10.00



SEALER'S BADGE

No. 10096. This polished German silver badge has convex front and is provided with a strong catch pin.

Price, \$1.50

No. 10096 B. Same as No. 10096, but with the word "POLICE" engraved on badge beside the inscription shown in cut. Price, \$1.50

OILSTONES

No.	Description	Price
10318	Arkansas Oilstone, fine quality,	\$0.25
10319	" " 3½ x 1 in., Mahogany Box, . . . . .	.75
10320	Washita " 3½ x 1 " Cherry " . . . . .	.45
10321	" " 5 x 2 " " " . . . . .	.75

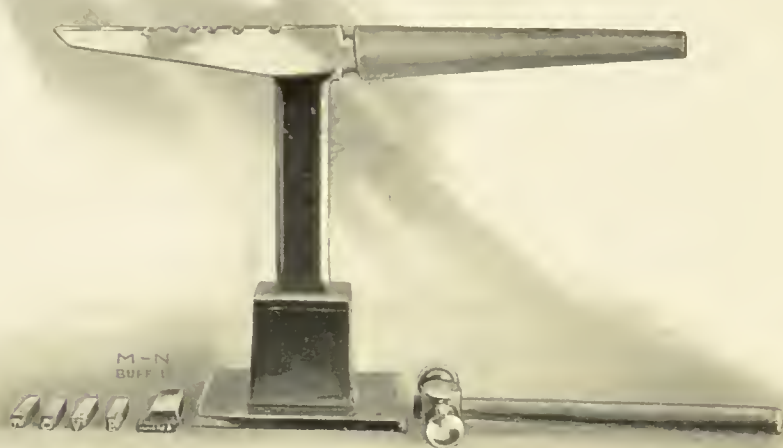
OILER

No. 10340. Oiler. The sealer often uses oil to remove rust or to lubricate the sliding parts of some scales.

Price, \$0.25

MACHINE OIL

No. 10345. Pure sperm machine oil, used in oiling bearing parts and in removing rust. Price, \$0.13



10130

10288



10129



10132

SEALING BLOCK

No. 10129. This heavy iron block is used by sealers as a base when sealing weights. Holes are provided so that knob weights may be sealed by stamping on the bottom.

Price, \$1.75

SEALER'S ANVIL OR STAKE

When the sealer stamps measures it is necessary to have an anvil or stake with a horn small enough and long enough to pass into the measure. Furthermore, it should be covered with lead in order to protect the steel dies or stamps.

No. 10130. This anvil is made of steel with a cast-iron socket base. It is well for the sealer to have two or more socket bases, one to be screwed to the wagon bed and the other to the work table in his office. One horn is covered with lead. Price, \$8.25

No. 10131. Extra socket base to fit No. 10130.

Price, \$1.25

No. 10132. This anvil is made of iron and has the horn covered with lead. The two guides and stops may be screwed to any wagon bed or table. When in use the horn is pulled out, when not in use it may be pushed back.

Price, \$3.00

No. 10133. Extra guides for No. 10132. Price, . \$0.75

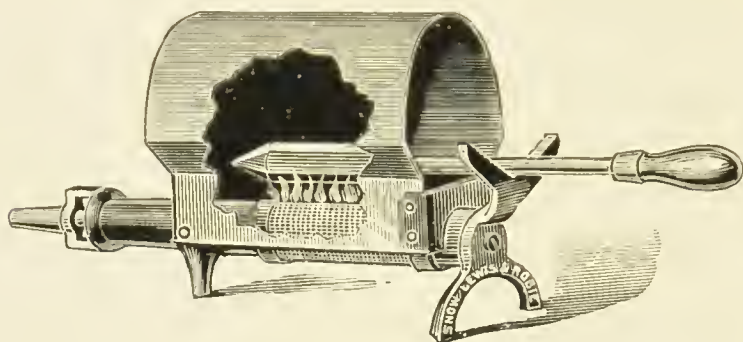
STRAIGHTENING IRONS

The sealer is often called on to straighten or smooth tin and other metal measures that have become more or less dented. This can be done easily by having a properly-shaped projecting iron firmly screwed to the work table and drawing the measure over the edge.

No. 10140. Straightening iron for smoothing the sides of measures, with projecting arm 18 inches long.

Price, \$5.00

No. 10141. Straightening iron for smoothing the bottom of measures. Price, \$5.00



10201

BURNING IRON HEATER

No. 10200. This heater produces a uniform heat and works well in any wind. It is provided with a first-class brass air pump. Price, \$5.50

No. 10201. When gas is available, it is far more convenient to use this form of heater than No. 10200. The hood may be removed. Price, \$1.35



10200

BURNING IRONS

These irons are used in marking or sealing wooden measures. To use them, the iron must be heated in an ordinary fire or in the heater No. 10200 or No. 10201. The letters are $\frac{1}{2}$ inch high.

No.		Price
10180	Burning iron with the word "BUSHEL,"	\$1.75
10181	" " " " " " $\frac{1}{2}$ BUSHEL,"	2.25
10182	" " " " " "PECK,"	1.50
10183	" " " " " " $\frac{1}{2}$ PECK,"	1.75

Prices given on application for burning irons with metric designations or with the date or name of the sealer's district.

No. 10190. Burning irons consisting of a metal frame and removable letters and figures are often very convenient, and where the sealer does not have frequent necessity for burning irons, the trouble of changing the type is of little consequence. Price of frame and type on application.

SEALED SHELBURNE 1908

10224

CONDEMNED

10220

RUBBER STAMPS

These rubber stamps are made especially for marking glassware, such as milk bottles, the ordinary rubber stamp not answering the purpose. These stamps are mounted on extra soft sponge rubber cushions and are provided with handles.

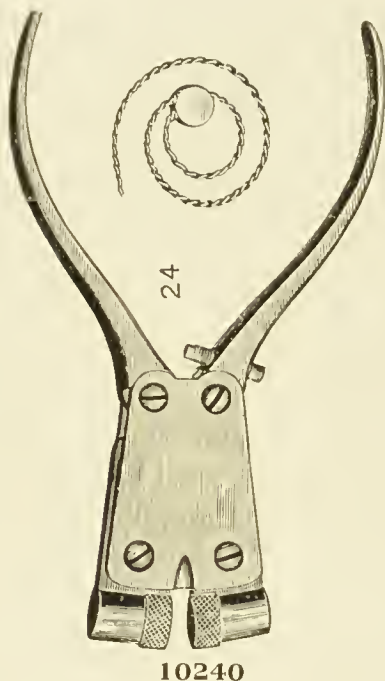
No.		Price
10220	Stamp with the word "CONDEMNED,"	\$0.75
10221	Stamp with the letters "CD," . . . . .	.50
10222	Stamp with one letter and the year, thus, "R. 06."	
	Used in sealing glass measures, . . . . .	.50
10223	Stamp with two letters and the year, thus, "R.C.06," . . . . .	.50
10224	Stamp with three lines (see illustration, page 113),	1.00
10225	Stamp with two lines similar to No. 10224, but with the date left off,	1.00

Prices of special rubber stamps with seals, etc., on application.

GLASS INK AND PAD

No.		Price
10230	Glass ink for marking with a stamp or pen on glass, in four-ounce rubber bottles, full directions accompany each bottle,	\$1.75
10231	Special pad to be used with the glass ink when using the rubber stamps. An ordinary pad will soon corrode, besides not holding the ink necessary for this purpose, . . . . .	.85

NOTE.—Allowance will be made for rubber bottles returned. Allowance is also made for the bottle when sent to be refilled. Special prices on larger quantities of the glass ink.



HAND SEAL PRESS AND WIRED LEAD SEALS

No. 10240. This compound lever seal press is forged from the best tool steel. It is compactly built and very powerful. The dies may be removed easily and new ones substituted. One die is engraved with the initial of the county, city, or town, and the other with the last two figures of the year. This latter must be replaced annually. Price, . . \$4.50

No. 10242. Seal blanks for the seal press No. 10240, engraved with a letter or with the year. Price, each, . . \$0.45

No. 10243. Wire lead seals for use with No. 10240. Price per hundred, \$0.32

No. 10244. This seal press is of the single lever type. It is larger than No. 10240. Price, engraved, . . . \$2.25

No. 10245. Extra jaws for seal press No. 10244, . . 0.60

STENCILS

Some sealers prefer to mark capacity measures with a stencil instead of the burning iron or the stamp. The following stencils are carefully cut in brass. The letters are $\frac{3}{4}$ inch high.

No. 10246. Three-line stencil with the word "SEALED," the name of the locality, and the year. Price, . . . \$1.25

No. 10247. Two-line stencil with the word "SEALED," and the name of the locality. Price, . . . \$1.00

No. 10248. One-line stencil with the word "Sealed." Price, . . . \$0.75

No. 10249. One-line stencil with the word "CONDEMNED." Price, . . . \$0.75

Stencils of other form or with letters of a different height. Prices on application.

VISES

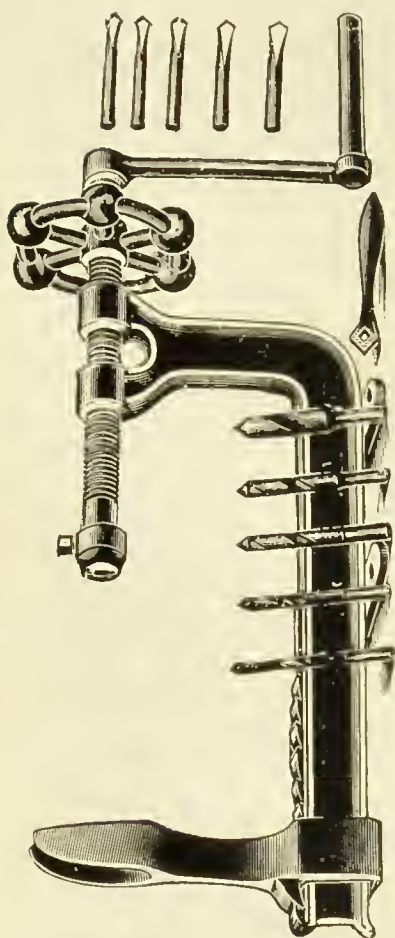
These vises are specially heavy and well made. They are designed for hard service and are not to be confounded with the cheap cast vises often used. When the sealer wishes to use a vise in his office only the stationary bottom style will answer, but in all cases, especially when clamped to a wagon, the swivel bottom will be found far more convenient.

VISES WITH STATIONARY BOTTOMS

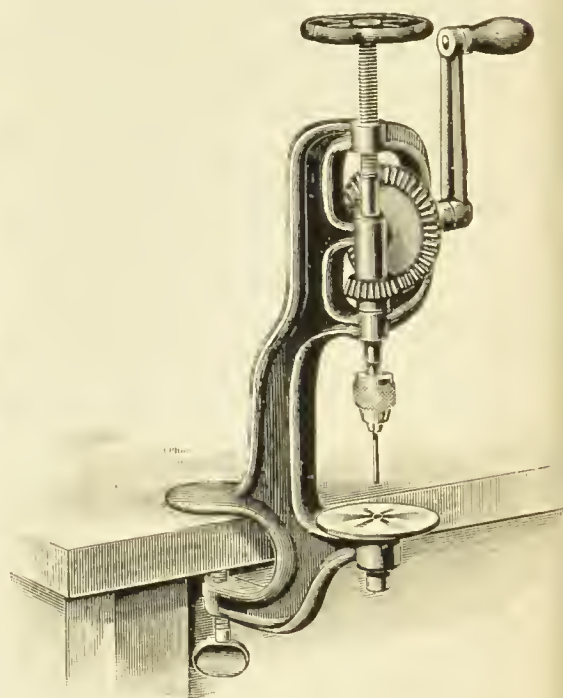
No.	Width of Jaws	Opens	Weight	Price
10250	$3\frac{1}{4}$ in.	4 in.	22 lb.	\$6.00
10251	$3\frac{5}{8}$ "	5 "	28 "	7.00
10252	$4\frac{1}{8}$ "	$5\frac{1}{2}$ "	42 "	8.50
10253	$4\frac{5}{8}$ "	$6\frac{1}{4}$ "	52 "	10.00
10254	5 "	7 "	72 "	13.00
10255	$5\frac{1}{2}$ "	$8\frac{1}{2}$ "	100 "	18.50
10256	6 "	$9\frac{1}{2}$ "	135 "	25.00

VISES WITH SWIVEL BOTTOMS

No.	Width of Jaws	Opens	Weight	Price
10257	$3\frac{1}{4}$ in.	4 in.	28 lb.	\$7.50
10258	$3\frac{5}{8}$ "	5 "	36 "	8.75
10259	$4\frac{1}{8}$ "	$5\frac{1}{2}$ "	52 "	10.50
10260	$4\frac{5}{8}$ "	$6\frac{1}{4}$ "	64 "	12.50
10261	5 "	7 "	85 "	16.00
10262	$5\frac{1}{2}$ "	$8\frac{1}{2}$ "	115 "	22.00
10263	6 "	$9\frac{1}{2}$ "	155 "	30.00



10270



10272

PORTABLE DRILL

No. 10270. This portable drill is one of the most useful tools that the sealer may have, as he can clamp it to any bench or table or to a wagon bed. Five twist drills are furnished. Price, \$2.90

No. 10271. Portable drill similar to No. 10270, but furnished with a universal chuck, which will hold any standard straight shank twist drill up to the capacity of the chuck. Price, \$6.50

No. 10272. Bench drill. This drill can be attached to any bench, table or wagon. Price, \$5.00

HANGER WEIGHTS

These weights are indispensable in the testing of steel-yards and platform scales. These weights are made of nickel-plated brass.

No. 10275. One-pound hanger weight, accurately adjusted. Price, \$3.00

PUNCHES

No. 10280. Steel punches. A set of three, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$ inch, used to drive in lead when adjusting weights. Price per set, \$0.30

HOLLOW PUNCH OR POINTER SET

No. 10282. This tool will be found useful in attaching pointers to dial spring balances. Price, \$0.25

LEAD PLUGGING WIRE

No. 10285. This lead wire is $\frac{1}{4}$ inch in diameter. It is used by the sealer to adjust weights found to be light. Price per pound, \$0.20

Special prices for larger quantities.

LEAD REMOVING REAMER AND HOOK

No. 10286. This hook is specially made for sealer's use in removing lead from weights when it becomes necessary. It is a combination countersink and hook and provided with a handle. Price, \$1.50

HAMMERS

No. 10288. Hammer with rounded ends, made of steel and especially adapted for sealers' use. Weight, $1\frac{1}{4}$ lbs. (See illustration, page 110.) Price, \$1.00

No. 10289. Machinists' ball pein hammer with rounded ends, made of steel. Price, \$1.00

WRENCHES

No. 10303. Nickel-plated $4\frac{1}{2}$ -inch steel bicycle wrench. Price, \$0.60

No. 10304. Six-inch monkey wrench, similar to No. 10305. Price, \$0.75

No. 10305. Monkey wrench. This knife-handle screw wrench is used by the sealer when he wishes to tighten or loosen bolts or nuts. Such a case often occurs in handling large scales. Length, 8 inches. Price, \$0.92

No. 10306. Monkey wrench, similar to No. 10305, 10 inches long. Price, \$1.00

No. 10307. Stillson's pipe wrench. Used in conjunction with another wrench or whenever a round or irregular rod has to be firmly held or turned. Length, 10 inches. Price, \$2.25

No. 10308. Pipe wrench, similar to No. 10307, 8 inches long. Price, \$2.00

No. 10309. Alligator wrench. Used in holding or turning any object. Price, \$0.40

No. 10312. Nose iron wrench for Fairbanks scales. This wrench is used to lengthen or shorten the leverage in a Fairbanks scale. The nose iron is found directly under the pillar. Price, \$3.00

No. 10313. Nose iron wrench for Howes platform scales. This serves the same purpose as No. 10314, but is for the Howe scales. Price, \$3.50

No. 10314. Wrench for spring balance pointers. The prongs of this wrench are placed over the pointer of the

dial form of spring balance and the pointer turned to the right or left. Price, \$1.00

No. 10315. Lifter or claw for spring balance pointers. This tool is used when the pointer has to be removed.

Price, \$0.75

FILES AND EMERY

No. 10325. Wood rasp. This is used for filing the ends of wooden measures that are too long or for filing end wood when necessary. Price, \$0.70

No. 10326. Small triangular file. This is used for removing rust, etc., from sharp corners and angular places.

Price, \$0.25

No. 10327. Small round file. This is used on curved surfaces and in testing the hardness of bearings and knife edges, when necessary. Price, \$0.25

No. 10328. Medium round file. This is used in the same manner as the small round file, but in larger places.

Price, \$0.50

No. 10329. Emery cloth. This is used for removing rust or cleaning metal parts. Price per six sheets, . . . \$0.25

No. 10330. Round emery sticks. These are most useful for cleaning curved bearings or rounded surfaces.

Price for six, \$0.75

No. 10331. Flat emery sticks. These are used in cleaning flat bearings or surfaces. Price for six, \$0.75

SCRAPER OR REAMER

No. 10334. Scraper or reamer. This is used to remove rust or rough places; also to enlarge holes or openings, or to take lead out of weights. Price, \$0.65

CHISEL

No. 10336. Half-inch chisel. A chisel is often used by the sealer for removing projecting parts of wooden bases and platforms. Price, \$0.30

No. 10337. One inch chisel. Price, \$0.45

SCREW-DRIVERS

- No. 10357. Large screw-driver. This screw-driver is sixteen inches long and is used on large screws requiring considerable power, for instance those on some platform scales. Price, \$1.35
- No. 10376. Medium screw-driver. This is used on large and medium sized screws. Price, \$0.35
- No. 10377. Small screw-driver. This is used on small screws, such as are found on small balances of almost all types. Price, \$0.25

PLIERS

- No. 10380. Pipe pliers, 8 inches long. These are used for straightening or bending small rods, such as hanger and tie rods. Price, \$0.50
- No. 10385. Flat nose side-cutting pliers with scraper and screw-driver ends on handle. The most convenient and universal pliers made. Price, \$0.90
- No. 10386. Same as 10385 but nickel-plated. Price, \$1.25

INSPECTION LAMP

- No. 10400. Electric inspection lamp. This is very convenient for the sealer when inspecting dormant platform scales or places which are not readily accessible. Price, \$1.25

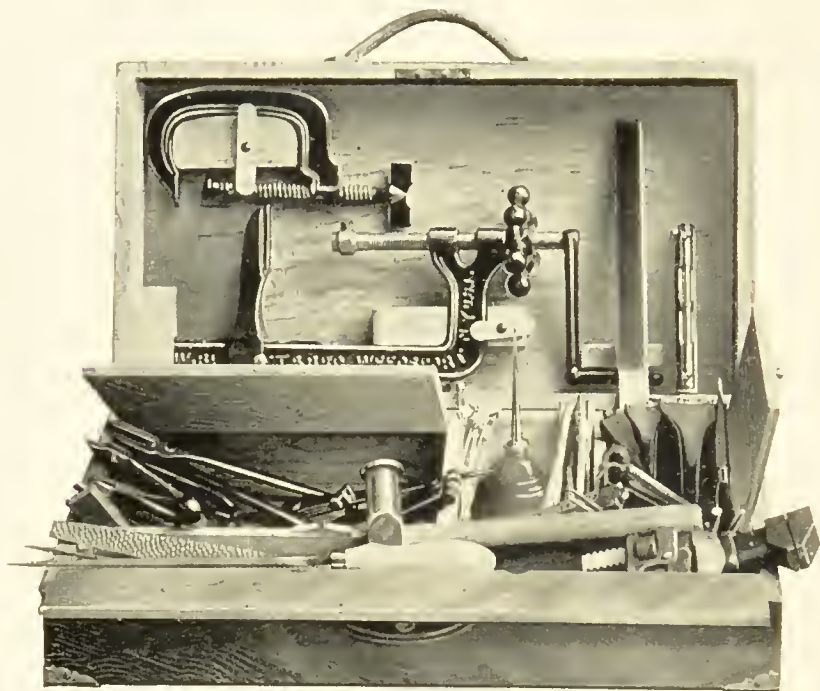
TRANSFER SPRING CALIPERS

These calipers are very useful in measuring the diameters of cylindrical measures and in transferring distances.

No.	Size	Price	No.	Size	Price
10410	6 in.	\$1.00	10412	10 in.	\$1.50
10411	8 "	1.25	10413	12 "	1.75

CLEANING BLADE

- No. 10420. This tool has a strong wooden handle and a steel blade 3 feet long. Price, \$3.00



SEALERS' KIT OF TOOLS

Every practical sealer of weights and measures should be provided with a kit of tools made for his needs in inspecting and, when necessary, correcting and adjusting. The tools are all of the best grade and are compactly arranged in a wooden chest or carrying case with lock and handles. There is sufficient room for additional tools and supplies, such as screws, pointers, gummed seals, etc., which every sealer will accumulate.

No. 10450. This kit contains the following:

1 Nose iron wrench, . . .	10312	1 One-pound hanger weight, . . .	10275
1 Nose iron wrench, . . .	10313	1 Inspection lamp, . . .	10400
1 Pointer wrench, . . .	10314	1 Measure gauge, . . .	10070
1 Monkey wrench, . . .	10305	1 Hammer, . . .	10289
1 Bicycle wrench, . . .	10303	1 Portable drill, . . .	10270
1 Alligator wrench, . . .	10309	1 Eight-fold four-foot rule, . . .	9168
1 Screw-driver, . . .	10375	1 Set punches, . . .	10280
1 Screw-driver, . . .	10376	1 Pointer set, . . .	10282
1 Screw-driver, . . .	10377	1 Bottle of shot, . . .	
1 Pipe pliers, . . .	10380	2 Pounds lead wire, . . .	10285
1 Pocket level, . . .	10105		

No. 10450—Continued.

1 Flat nose pliers, . . .	10385	6 Round emery sticks, . . .	10330
1 Cutting nippers, . . .	10390	1 Scraper or reamer, . . .	10334
1 Lead removing reamer, . . .	10286	1 Chisel,	10337
1 Rasp,	10325	1 Transfer calipers, . . .	10411
1 Round file,	10327	1 Oil can,	10340
1 Round file,	10328	Machine oil,	10345
1 Triangular file,	10326	1 Oil stone,	10319
6 Sheets emery cloth, . . .	10329	1 Hand seal press,	10240
6 Flat emery sticks, . . .	10331	100 Wired lead seals, . . .	10243

Price complete with chest, \$51.00

No. 10455. This kit contains the following:

1 Nose iron wrench, . . .	10312	1 Scraper or reamer, . . .	10334
1 Nose iron wrench, . . .	10313	1 Eight-fold four-foot rule, . . .	9168
1 Pointer wrench, . . .	10314	1 One-pound hanger weight, . . .	10275
1 Bicycle wrench, . . .	10303	1 Hand seal press,	10240
1 Pipe pliers,	10380	100 Wired lead seals, . . .	10243
1 Flat nose pliers, . . .	10385	1 Pocket level,	10100
1 Screw-driver,	10375	1 Hammer,	10289
1 Screw-driver,	10376	1 Portable drill,	10270
1 Screw-driver,	10377	1 Set punches,	10280
1 Rasp,	10325	1 Bottle of shot,	
1 Triangular file,	10326	2 Pounds lead wire,	10285
6 Sheets emery cloth, . . .	10329	1 Lead removing reamer, . . .	10286

Price complete with chest, \$37.50

No. 10460. This kit contains the following:

1 Nose iron wrench, . . .	10312	1 Scraper or reamer, . . .	10334
1 Nose iron wrench, . . .	10313	1 Bottle of shot,	
1 Pointer wrench, . . .	10314	1 Set punches,	10280
1 Bicycle wrench, . . .	10303	1 Hammer,	10289
1 Pipe pliers,	10380	1 Portable drill,	10270
1 Screw-driver,	10376	1 One-pound hanger weight, . . .	10275
1 Screw-driver,	10377	1 Hand seal press,	10244
1 Round file,	10327	100 Wired lead seals, . . .	10243
6 Sheets emery cloth, . . .	10329		

Price complete with chest, \$30.00

TOOL CHESTS for sealers. Prices and description on application.

SEALERS' RECEIPT AND RECORD BOOK

These duplicate receipt and record books are numbered in pairs with alternate leaves perforated. As the sealer inspects and tests any weights, scales or measures, he makes a record in this book. On completing his work at a certain place he tears out the original receipt and gives it to the owner of the apparatus tested. The carbon copy remains in the book as an official record to check fees (when fees are collected) and to make reports. Each book or pad contains 200 sheets, 100 of each color, and is furnished with a carbon paper.

Cat. No.	Quantity	Price
10501	1 book or pad	\$1.00
10502	2 books or pads	1.90
10503	3 " " "	2.75
10504	4 " " "	3.50
10505	5 " " "	4.25

SEALERS' NO-CHARGE RECEIPT AND RECORD BOOK

(Used in Massachusetts.)

These "No-Charge" books are used by the sealers in their office tests when no charge is made. Alternate leaves are perforated, the book is stitched and bound in paper. The person bringing apparatus to be tested receives the original and the copy remains in the sealer's possession as a record. Each book or pad contains 200 sheets, 100 of each color, and is furnished with carbon paper.

Cat. No.	Quantity	Price
10510	1 book or pad	\$1.50
10511	2 books or pads	2.75
10512	3 " " "	3.75
10513	4 " " "	5.00
10514	5 " " "	6.00

NOTE.—When desired, the seal of the city, county, or town may be printed on each leaf. The price depends on whether the electrotype is furnished or has to be specially made. Details and prices on application.

NO.

WEIGHTS AND MEASURES DEPARTMENT

Record of Coal Re-Weighings

City or Town _____ 19____

No. of Weight Certificate _____ Hour _____

Name of Seller _____ Place of Business _____

Name of Purchaser _____ Where to be Delivered _____

Name of Sworn Weigher _____ Name of Teamster _____

Certificate Demanded at _____ Sealer Where Re-Weighed _____

RESULTS OF WEIGHING

	Weight as Indicated by Seller's Certificate	Weight as found by Sealer on Re-weighing
Gross Weight		
Tare		
Weight of Coal		
	Overweight	Underweight
	_____ lbs	_____ lbs

Remarks: _____

_____ Sealer

COAL REWEIGHING SLIPS
(MASSACHUSETTS PATTERN)

When the sealer reweighs or remeasures coal it is important that he have an accurate record of the work done and the results. These pads are printed in duplicate, 200 pages to a pad, alternate leaves are perforated and carbon paper is furnished.

Cat. No.	Quantity	Price
10516	1 pad	\$1.00
10517	2 pads	1.60
10518	3 "	2.25
10519	4 "	2.75
10520	5 "	3.00

COAL REWEIGHING BOOK

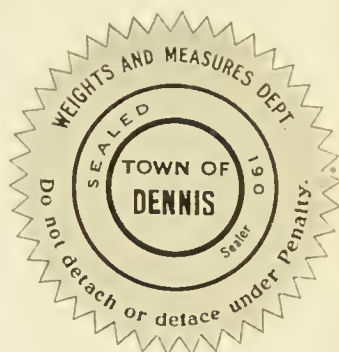
No. 10525. This book forms an office record of the coal reweighings made by the sealer. The book is bound in heavy linen canvas and has 500 pages, two records on each page. Price, \$4.50

SEALERS' RECORD BOOK
(MASSACHUSETTS PATTERN)

No. 10527. This book forms an office record of all the work done by the sealer. It is properly ruled with headings printed on each page. The binding is of linen canvas. The book is 12 x 10 inches and contains 100 pages.
Price, \$2.50



10536



10530

(Cuts Reduced Size)

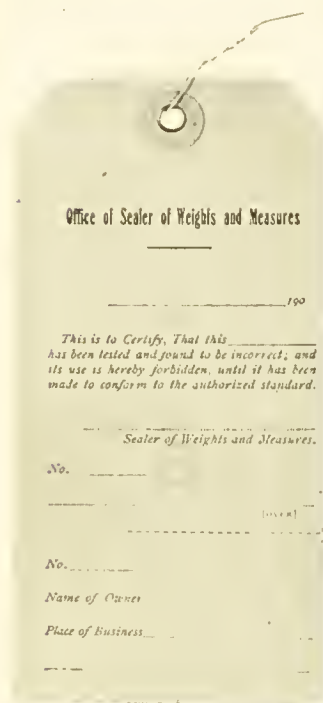
GUMMED PAPER SEALS

These seals are printed on the best quality green glazed paper. The seals are 2 inches in diameter with notched rim, and when placed on a balance or scale can be easily seen. Great care has been exercised in securing extra strong adhesive gum, but in spite of that it is recommended that the surface to which they are attached be clean. If necessary, the sealer should remove grease by wiping the part of the scale with a slightly alkali solution like soda or dilute potash. The seals are printed with the name or seal of the town, city, or county, as desired. (If the seal is desired, an electrotype of the proper size must be furnished.)

Cat. No.	Quantity	Price
10530	300 or less seals	\$1.75
10531	500	2.00
10532	1,000	2.40

GUMMED SEALS FOR NEW YORK STATE SEALERS

Cat. No.	Quantity	Price
10536	100	\$0.75
10537	300	1.25
10538	500	1.50
10539	1,000	2.40



CONDEMNING TAGS

Sealers generally use condemning tags to mark scales, etc., which are found to be inaccurate yet may be repaired. These are attached with a wired lead seal, making use of the pliers (No. 10380 or No. 10385). The tags are wired and printed on heavy card board. The card is perforated near its lower end, so that the sealer may detach part of the tag and keep a record of the particular scale or other apparatus condemned for repairs.

Cat. No.	Quantity	Price	Cat. No.	Quantity	Price
10545	25 tags	\$0.25	10549	250 tags	\$1.00
10546	50 "	.35	10550	400 "	1.50
10547	100 "	.55	10551	500 "	1.75
10548	200 "	.85	10552	1,000 "	3.00

SHIPPING OR MARKING TAGS

The sealer often has occasion to mark articles. These heavy card tags strung with strong twine will be found a necessity.

Cat. No.	Quantity	Price	Cat. No.	Quantity	Price
10560	100 tags	\$0.35	10563	400 tags	\$0.80
10561	200 "	.50	10564	500 "	.95
10562	250 "	.60	10565	1,000 "	1.85

SEALERS' STANDARDS EQUIPMENT

In order to facilitate the selection of apparatus and the estimation of its cost, a few suggestive outfits are given below.

No. 10600. Standard equipment for a State, county, or large city.

Apparatus	No.	Apparatus	No.
Large balance,	9570	Set capacity measures, . . .	9850
Small balance,	9590	Set capacity measures, . . .	9851
1 Accurate Assay balance,		Set capacity measures, . . .	9970
Set avoirdupois weights, .	9213	Capacity measure,	9981
Set Troy weights,	9280	Capacity measure,	9982
Set metric weights,	9173	Standard yard,	9003
Set metric weights,	9261	Standard meter,	9004
Set grain weights,	9241		

Price, \$1,445.00

No. 10605. Same as above, but with the addition of case

No. 9675. Price, \$1,600.00

No. 10608. Standard equipment for State, county, or city, where only metric weights and measures are tested.

Apparatus	No.	Apparatus	No.
Large balance,	9570	Set capacity measures, . . .	9851
Small balance,	9590	Capacity measure,	9981
1 Assay balance,		Capacity measure,	9982
Set metric weights,	9173	Standard meter,	9001
Set metric weights,	9261		

Price, \$790.00

No. 10610. Same as No. 10608, but with the addition of case No. 9675. Price, \$950.00

Besides the above, the sealer should have a bench standard of length (see page 46).

A State Sealer should have, besides his standards, some representative sets of working apparatus, illustrating the equipment of a city, county, or town sealer.

Standards equipment for a county, city, or town, where only customary weights and measures are sealed.

Apparatus	No. 10650	No. 10652	No. 10654	No. 10656
Case,	9675	9675	9675	9675
Large balance,	9570	9570	9575	9575
Set avoirdupois weights,	9420	9300	9420	9419

Apparatus	No.10650	No.10652	No.10654	No.10656
Set avoirdupois weights,	9303		9303	9303
Set capacity measures, .	9930	9850	9890	9893
Set capacity measures, .	10000	9970	10000	10000
Standard Yard, . . .	9000	9003	9000	9012
Price,	\$450.00	\$685.00	\$445.00	\$415.00

No. 10660. Same as No. 10650, but with the addition of small balance No. 9590. Price, \$545.00

No. 10663. Same as No. 10652, but with the addition of small balance No. 9590. Price, \$775.00

No. 10666. Same as No. 10654, but with the addition of small balance No. 9590. Price, \$535.00

No. 10669. Same as No. 10656, but with the addition of small balance No. 9590. Price, \$505.00

Standards equipment for a county, city, or town, where only metric weights and measures are sealed.

Apparatus	No.10675	No.10677	No.10679	No.10681
Case,	9675	9675	9675	9675
Large balance, . . .	9570	9570	9575	9575
Set metric weights, .	9328	9422	9454	9511
Set metric weights, .		9332	9332	9332
Set metric weights, .	9260	9260	9484	9484
Set capacity measures, .	9851	9932	9894	9897
Set capacity measures, .	9971	10013	10027	10027
Standard meter, . . .	9004	9001	9001	9013
Price,	\$680.00	\$421.00	\$411.00	\$375.00

Standards equipment for a county, city, or town, where customary and metric weights and measures are sealed.

Apparatus	No.10700	No.10702	No.10704	No.10706
Case,	9675	9675	9675	9675
Large balance, . . .	9570	9570	9575	9575
Set avoirdupois weights,	9300	9420	9420	9419
Set avoirdupois weights,		9303	9303	9303
Set metric weights, .	9328	9454	9422	9422
Set metric weights, .		9332	9332	9332
Set metric weights, .	9260	9260	9260	9484
Set capacity measures, .	9850	9930	9890	9893
Set capacity measures, .	9851	9932	9895	9897
Set capacity measures, .	9970	10000	10002	10035
Standard meter and yard,	9002	9002	9002	9002
Price,	\$860.00	\$556.00	\$510.00	\$435.00

WORKING EQUIPMENTS

In addition to one of the foregoing or similar Standards Equipments, the sealer requires apparatus to properly inspect and seal. One of the following is recommended:

Apparatus	No. 10751	No. 10752	No. 10753
1 Portable balance,	9560	9562	9562
1 Set weights,	9303	9303	9303
1 Set weights,	9419	9419	9419
1 Set liquid measures,	9931	9931	9967
1 Set dry measures,	10035	10035	10035
1 Yard standard,	9015	9015	9015
1 Seal press,	10240	10240	10240
500 Lead seals,	10243	10243	10243
Gummed seals,	10538	10531	10531
Condemn tags,	10548	10548	10548
Receipt book,	10501	10501	10501
Rubber stamp,	10225	10225	10225
Rubber stamp,	10220	10220	10220
Acid pad,	10231	10231	10231
Etching acid,	10230	10230	10230
Dry measure gauge,	10070	10070	10070
1 Steel stamp,	10159B	10157	10157
1 Steel stamp,	10155B	10158	10158
1 Steel stamp,	10160	10159	10159
1 Steel stamp,		10160	10160
Price,	\$120.00	\$127.00	\$112.00

No.					Price
10761	same as 10751, but with	10 fifty-pound weights,			\$150.00
10762	" " " "	20 " "			180.00
10763	" " " "	40 " "			240.00
10766	" 10752	10 " "			157.00
10767	" " " "	20 " "			187.00
10768	" " " "	40 " "			247.00
10771	" 10753	10 " "			142.00
10772	" " " "	20 " "			172.00
10773	" " " "	40 " "			232.00

A kit of tools (see page 123) should be in the possession of the sealer in addition to the above.

The above working equipments from 10761 to 10773 are recommended by the State Department of Weights and Measures of Massachusetts and New York.

SEALERS' OFFICE WORKING EQUIPMENT

In addition to the apparatus enumerated on the preceding pages, the sealer will require a working equipment for inspections made at the office.

No. 10780. The following are of heavy construction and specially made for office use.

Case truck,	10094
Hopper funnel,	10040
Vise,	10251
Drill,	10272
Sealing block,	10129
Sealers' anvil,	10130
Straightening iron,	10140
Measuring reel,	10068
Slicker plate,	10078
Striking stick,	10075
Spring balance stand,	10091
Burning iron heater,	10201
Suspended platform,	9406
Bucket measure,	9870

Price, \$158.00

We are also prepared to make special or heavier apparatus if needed.

DIRECTIONS FOR USING TABLES

(Pages 134-137)

The tables of tolerances given are merely suggestive, and for that reason sufficient blank space has been left for the sealer who uses this handbook to add whatever data or to make whatever changes the law in his particular locality requires.

The values given for the allowable errors are very liberal and in most cases should be reduced.

Having found the value of a certain measure or weight which is being tested, the sealer should look up in the table of allowable errors and find what error is permissible in that particular case, and then seal or condemn accordingly.

LINEAR MEASURES WOODEN OR METAL MEASURES

Length	Allowable error	Local allowable error	Remarks
21 to 15 feet	$\frac{3}{32}$ in.		
14 to 6 "	$\frac{1}{16}$ "		
5 to 3 "	$\frac{1}{32}$ "		
Less than one yard	$\frac{1}{64}$ "		
10 to 7 meters	3 millimeters		
6 to 4 "	2 "		
3 to 2 "	.8 "		
1 meter	.6 "		
.5 "	.4 "		

TAPES (stretching force between 3 and 18 lbs.)

100 to 75 feet	$\frac{3}{8}$ in.
75 to 30 "	$\frac{1}{4}$ "
29 to 20 "	$\frac{1}{8}$ "
19 to 12 "	$\frac{3}{32}$ "
11 to 6 "	$\frac{1}{16}$ "
3 feet	$\frac{1}{32}$ "
25 to 20 meters	10 millimeters
15 to 10 "	6 "
9 to 7 "	3 "
6 to 4 "	1.5 "
3 to 2 "	1 "
1 meter	.75 "

CHAINS

100 to 66 feet	.75 in.
65 to 25 "	.5 "
25 to 20 meters	2 centimeters
10 to 5 "	1.5 "

COMMERCIAL LIQUID CAPACITY MEASURE

Measure	ALLOWABLE ERROR		Local Allowable Error
	In Excess	In Deficiency	
10 gallons	15 dr. or 3.33 cu. in.	8 drams or 1.8 cu. in.	
5 "	8 " " 1.8 "	6 " " 1.33 "	
2 "	7 " " 1.57 "	5 " " 1.13 "	
1 "	6 " " 1.33 "	4 " " .9 "	
2 qt.	4 " " .9 "	3 " " .66 "	
1 "	4 " " .9 "	3 " " .66 "	
1 pt.	3 " " .66 "	2 " " .44 "	
$\frac{1}{2}$ "	3 " " .66 "	$1\frac{1}{2}$ " " .33 "	
1 gill	2 " " .5 "	1 " " .25 "	
$\frac{1}{2}$ "	2 " " .5 "	1 " " .25 "	
40 liters	60 cc.	40 cc.	
25 "	50 "	30 "	
10 "	35 "	20 "	
5 "	25 "	15 "	
4 "	22 "	15 "	
2 "	15 "	10 "	
1 liter	15 "	10 "	
$\frac{1}{2}$ "	11 "	7.5 "	
2 decil.	8 "	3 "	
1 "	5 "	1.5 "	

DRY CAPACITY MEASURES

Measure	ALLOWABLE ERROR		Local Allowable Error
	In Excess	In Deficiency	
5 bu.	25 cu. in.	17 cu. in.	
4 "	20 "	15 "	
2 "	18 "	10 "	
1 "	10 "	6 "	
$\frac{1}{2}$ "	8 "	4 "	
1 peck	6 "	3 "	
$\frac{1}{2}$ "	5 "	3 "	
$\frac{1}{4}$ "	4 "	2 "	
1 quart	2 "	1 "	
1 pint	2 "	1 "	
$\frac{1}{2}$ "	1 "	$\frac{1}{2}$ "	
1 hectoliter	325 cc.	200 cc.	
$\frac{1}{2}$ "	160 "	100 "	
$\frac{1}{4}$ "	120 "	75 "	
2 decaliters	100 "	60 "	
1 decaliter	75 "	50 "	
8 liters	75 "	50 "	
5 "	60 "	35 "	
2 "	60 "	35 "	
1 liter	30 "	15 "	
$\frac{1}{2}$ "	25 "	12 "	

AVOIRDUPOIS TRADE WEIGHTS

Weight		Allowable Error	Local Allowable Error	Remarks
50	lb.	140 grains or $\frac{5}{16}$ oz.		
30	"	88 " " $\frac{1}{4}$ "		
25	"	80 " " $\frac{3}{16}$ "		
20	"	70 " " $\frac{3}{16}$ "		
15	"	52 " " $\frac{1}{8}$ "		
10	"	36 " " $\frac{1}{16}$ "		
5	"	22 " " $\frac{1}{16}$ "		
4	"	18 " " "		
3	"	14 " " "		
2	"	10 " " "		
1	"	7 " " "		
8	oz.	3.5 " " "		
4	"	2 " " "		
2	"	2 " " "		
1	"	2 " " "		
$\frac{1}{2}$	"	1 " " "		
$\frac{1}{4}$	"	1 " " "		
$\frac{1}{8}$	"	1 " " "		
$\frac{1}{16}$	"	1 " " "		

METRIC TRADE WEIGHTS

50 kilograms	10 grams
30 "	9 "
25 "	8.5 "
20 "	8 "
15 "	6.5 "
10 "	5 "
5 "	2.5 "
4 "	2.2 "
3 "	1.7 "
2 "	1.2 "
1 "	.8 "
500 grams	500 milligrams
200 "	200 "
100 "	120 "
50 "	100 "
20 "	60 "
10 "	40 "
5 "	32 "
2 "	24 "
1 "	20 "

TROY AND APOTHECARIES' WEIGHTS

Weight	Allowable Error	Local Allowable Error	Remarks
50 lb.	60 grains		
500 oz.	50		
25 lb.	35		
300 oz.	35		
200 "	30		
15 lb.	30		
10 "	16		
100 oz.	14		
5 lb.	10		
50 oz.	8		
4 lb.	8		
40 oz.	8		
3 lb.	8		
40 oz.	6		
2 lb.	6		
20 oz.	5		
1 lb.	4		
10 oz.	4		
6 oz.	2		
5 oz.	2		
2000 gr.	1.5		
4 oz.	1.5		
3 oz.	1.5		
1000 gr.	1.5		
2 oz.	1.5		
500 gr.	1		
1 oz.	1		
10 pwt.	.6		
200 gr.	.6		
5 pwt.	.4		
100 gr.	.4		
50 gr.	.3		
2 pwt.	.3		
25 gr.	.2		
1 pwt.	.2		
12 gr.	.2		
6 gr.	.2		
3 gr.	.1		
2 gr.	.1		
1 gr.	.05		

CLASSIFICATION OF WEIGHTS

ADOPTED BY THE BUREAU OF STANDARDS

January 1, 1906

Class A. Reference standards for chemists and State sealers.

Class B. Working standards used by chemists, city sealers, etc.

Class C. Accurate commercial weights used by druggists, jewelers, etc.

A. For certification in class A and sealing, weights must be of one piece and non-oxidizable.

B. For certification in class B and sealing, weights must be non-oxidizable, and of such material that the density may be fairly assumed.

TOLERANCES

Weights *	Class A	Class B	Class C
20 kilograms	100 milligrams	200 milligrams	1500 milligrams
10 "	50 "	100 "	750 "
5 "	25 "	50 "	400 "
2 "	10 "	20 "	200 "
1 "	5 "	10 "	100 "
500 grams	3 "	5 "	50 "
200 "	1 "	2 "	20 "
100 "	0.5 "	1 "	10 "
50 "	0.3 "	0.5 "	5 "
20 "	0.1 "	0.2 "	2 "
10 "	0.1 "	0.2 "	2 "
5 "	0.1 "	0.2 "	2 "
2 "	0.05 "	0.1 "	1 "
1 "	0.05 "	0.1 "	1 "
500 milligrams	0.04 "	0.08 "	1 "
200 "	0.03 "	0.06 "	0.5 "
100 "	0.03 "	0.05 "	0.5 "
50 "	0.02 "	0.05 "	0.5 "
20 "	0.02 "	0.04 "	0.3 "
10 "	0.02 "	0.04 "	0.3 "
5 "	0.01 "	0.03 "	0.2 "
2 "	0.01 "	0.02 "	0.1 "
1 "	0.01 "	0.02 "	0.1 "

*For weights of other denominations the nearest metric weight here given will determine the tolerance.

TABLES OF EQUIVALENTS

On pages 103 to 113 are given tables showing the progressive building up of the weights and measures and then tables of equivalents arranged alphabetically. In these latter tables the equivalent of a unit of each measure is found. Long conversion tables have been omitted on purpose, as it is a matter of the simplest multiplication to find the value of a multiple of the unit. Also the equivalents are given in the corresponding units, for instance, the equivalent of one kilogram is given in pounds and not in ounces, penny-weights, etc., these latter being easily found by consulting the tables first given.

Often the sealer wishes to know only the approximate equivalent, and in that case the values given in the last column may be consulted.

Those who desire more complete tables of equivalents and most excellent conversion tables should procure a copy of Hering's "Conversion Tables."

THE METRIC SYSTEM

As this system has been adopted or legalized by practically every civilized nation, the sealer of weights and measures should become acquainted with it. The simplicity of the system is due to the following properties:—(1) it is decimal, (2) there are only three units, (3) these units are related to one another in the simplest possible manner, (4) the same seven prefixes are used for the sub-multiples and multiples of all the three units.

The fundamental unit is the unit of length, the *meter*.

The unit of mass or weight is the *gram*, which equals the weight of one cubic centimeter ($\frac{1}{1000}$ meter) of water.

The unit of capacity is the *liter*, which equals $\frac{1}{1000}$ of a cubic meter or 1000 cubic centimeters.

The prefixes used are the following:—

Milli—, which means	$\frac{1}{1000}$
Centi—, " "	$\frac{1}{100}$
Deci—, " "	$\frac{1}{10}$
Deca—, " "	10

Hecto—, which means	100
Kilo—, “ “	1000
Myria—, “ “	10000

The simplicity of the system may be understood from this problem:

What quantity of water by measure and weight will it take to fill a tank $2.5 \times 2.6 \times 1.5$ meters?

Solution: $2.5 \times 2.6 \times 1.5 = 9.75$ cubic meters. Therefore the tank will hold 975 liters or 975 kilograms or .975 metric tons of water.

Anyone who will work a similar problem, using yards, gallons, pounds, and tons, will be convinced of the simplicity of the metric system.

LENGTH

10 millimeters (mm.)	= 1 centimeter (cm.)
10 cm.	= 1 decimeter (dm.)
10 dm.	= 1 meter (m.)
10 m.	= 1 decameter (dcm.)
10 dcm.	= 1 hectometer (hm.)
10 hm.	= 1 kilometer (km.)

SURFACE

The surface measures are the squares of the linear measures, but for land measure 100 square meters are called an “*ar.*”

100 ars (a.)	= 1 hectare (ha.)
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CAPACITY

10 milliliters (ml.)	= 1 centiliter (cl.)
10 cl.	= 1 deciliter (dl.)
10 dl.	= 1 liter (l.)
10 l.	= 1 decaliter (dcl.)
10 dcl.	= 1 hectoliter (hl.)
10 hl.	= 1 kiloliter (kl.)

WEIGHT

10 milligrams (mg.)	= 1 centigram (cg.)
10 cg.	= 1 decigram (dg.)
10 dg.	= 1 gram (g.)
10 g.	= 1 decagram (dcg.)
10 dcg.	= 1 hectogram (hg.)
10 hg.	= 1 kilogram (kg.)
10 kg.	= 1 myriagram (mrg.)
10 mrg.	= 1 metric ton (t.)

UNITED STATES AND ENGLISH LINEAR MEASURE

12 inches (in.)	= 1 foot (ft.)	
3 ft.	= 1 yard (yd.)	= 36 in.
5½ yd.	= 1 rod (rd.)	= 16½ ft.
320 rd.	= 1 mile (mi.)	= 1760 yd. = 5280 ft.

SURVEYOR'S MEASURE

625 square links (sq. li.)	= 1 square rod (sq. rd.)
16 sq. rd.	= 1 square chain (sq. ch.)
10 sq. ch.	= 1 acre (a.)
640 a.	= 1 square mile (sq. mi.)
36 sq. mi. (6 mi. square)	= 1 township (tp.) = 23040 a.

CHAIN MEASURE

(Surveyor's or Gunter's Chain)

7.92 inches	= 1 link (li.)
100 li.	= 1 chain (ch.) = 66 ft.
80 ch.	= 1 mile (mi.)

The engineer's chain is 100 feet long and consists of 100 links.

SQUARE MEASURE

144 square inches (sq. in.)	= 1 square foot (sq. ft.)
9 sq. ft.	= 1 square yard (sq. yd.)
30¼ sq. yd.	= 1 square rod (sq. rd.)
160 sq. rd.	= 1 acre (a.)

UNITED STATES AND ENGLISH LIQUID MEASURE

4 gills (gi.)	= 1 pint (pt.)
2 pt.	= 1 quart (qt.) = 8 gi.
4 qt.	= 1 gallon (gal.) = 8 pt. = 32 gi.
31½ gal.	= 1 barrel (bbl.) = 126 qt.
2 bbl.	= 1 hogshead (hhd.) = 63 gal. = 252 qt.

CUBIC MEASURE

1728 cubic inches (cu. in.)	= 1 cubic foot (cu. ft.)
27 cu. ft.	= 1 cubic yard (cu. yd.)

U. S. DRY MEASURE

2 pints (pt.)	= 1 quart (qt.)
8 qt.	= 1 peck (pk.) = 16 pt.
4 pk.	= 1 bushel (bu.) = 32 qt. = 64 pt.

APOTHECARIES' FLUID MEASURE

60 minims (m.)	= 1 fluid dram (fl. dr.)
8 fl. dr.	= 1 fluid ounce (fl. oz.) = 480 m.
16 fl. oz.	= 1 pint (O.) = 128 fl. dr. = 7680 m.
8 O.	= 1 gallon (cong.) = 128 fl. oz. = 1024 fl. dr.

AVOIRDUPOIS WEIGHT

27 $\frac{11}{32}$ grains (gr.)	= 1 dram (dr.)
16 dr.	= 1 ounce (oz.) = 437 $\frac{1}{2}$ gr.
16 oz.	= 1 pound (lb.) = 156 dr. = 7000 gr.
100 lb.	= 1 hundred weight (cwt.) = 1600 oz.
20 cwt.	= 1 ton (t.) = 2000 lb.
	(In long measure.)
112 lb.	= 1 cwt.
20 cwt.	= 1 long ton (t.) = 2240 lb.

TROY WEIGHT

24 grains (gr.)	= 1 pennyweight (dwt.)
20 dwt.	= 1 ounce (oz.) = 480 grains.
12 oz.	= 1 pound (lb.) = 240 dwt. = 5760 gr.

APOTHECARIES' WEIGHT

20 grains (gr.)	= 1 scruple (℥)
3 ℥	= 1 dram (℥) = 60 gr.
8 ℥	= 1 ounce (℥) = 24 ℥ = 480 gr.
12 ℥	= 1 pound (℔) = 96 ℥ = 288 ℥ = 5760 gr.

Lengths	Abbreviations	Equivalents	Approximate Equivalents
1 barleycorn	bc.	8.4667 millimeters	8.5
1 bolt	b.	$\frac{1}{3}$ inch 36.5760 meters	36.5
1 centimeter	cm.	40. yards .3937 inch	.4
1 chain	ch.	20.117 meters	20.1
Gunther's		66. feet	
1 chain	ch.	30.480 meters	30.5
engineer's		100. feet	
1 fathom	f.	1.8288 meters	$\frac{9}{5}$
(U. S.)		6. feet	
1 fathom	f.	1.853 meters	$\frac{11}{6}$
(British)		6.080 feet	
1 foot	ft.	30.4801 centimeters	30.5
(U. S.)		1.0000029 ft. (British)	1
1 foot	ft.	30.4800 centimeters	30.5
(British)		.9999971 ft. (U. S.)	1
1 furlong	fur.	201.17 meters	200
		660. feet	
1 inch	in.	2.5400 centimeters	2.5
		1000. mils.	
1 kilometer	km.	3280.83 ft.	3300

Lengths	Abbreviations	Equivalents		Approximate Equivalents
		.6214	mile (statute or land)	
1 knot	k.	1.8533	kilometers	$2\frac{3}{4}$
or nautical mile		1.1515	miles	$1\frac{1}{8}$
1 league (U. S.)	l.	4.8281	kilometers	$4\frac{7}{8}$
		3.	miles	
1 link	li.	20.117	centimeters	20.1
surveyor's				
1 link	li.	30.480	centimeters	$30\frac{1}{2}$
engineer's				
1 meter	m.	39.370000	in. (U. S.)	40
		39.370113	in. (British)	40
		1.0936	yards	1.1
1 micro-millimeter	$\mu\mu$.	.00003937	mil.	
		.000001	millimeter	
1 micron	μ .	.03937	mil.	
		.001	millimeter	
1 mil		.0254	millimeter	
		.001	inch	
1 mile	ml.	1609.35	meters	1600
(statute or land)				
		1.6094	kilometers	$1\frac{2}{3}$
		.8684	knot	$\frac{7}{8}$
1 mile	ml.	7422.	meters	7400
geographical international				
		4.6118	miles	$4\frac{2}{3}$
1 mile	ml.	1	knot	
nautical				
1 mile	ml.	1852	meters	
nautical international				
		1.1508	miles	$1\frac{1}{6}$
1 millimeter	mm.	.03937	inch	$\frac{1}{25}$
		39.37	mils.	40
1 perch, pole or rod	p., r.	5.0292	meters	5
1 vara	v.	.8476	meter	$\frac{7}{8}$
		33.372	inches	$33\frac{1}{3}$
1 yard (U. S.)	yd.	91.4402	centimeters	90
		.9144	meter	.9
		1.0000029	yd. (British)	1
1 yard (British)	yd.	91.4399	centimeters	90
		.9144	meters	
		.9999971	yd. (U. S.)	1

Area or Surface Measure	Abbreviations	Equivalents		Approximate Equivalents
1 acre	a.	40.4687 4046.87 .4047	ares sq. meters hectare	40 4000 .4
1 are or ar	a.	100. 1076.387 .0247	sq. meters sq. ft. acre	1100
1 circular mil.	cm.	.0006452 .0005067	circular millimeter sq. milli- meter	
1 circular millimeter	cmm	1550.00 .7854	circular mils. sq. millimeter	1500 $\frac{3}{4}$
1 square centimeter	$\overline{\text{cm}}^2$	.1550	sq. in.	$\frac{1}{16}$
1 square chain (surveyors')	sq. ch.	404.687 4.0469	sq. meters ares	400 4
1 square decimeter	$\overline{\text{dm}}^2$	15.500 .10764	sq. in. sq. ft.	.1
1 square foot (U. S.)	sq. ft.	929.034 1.0000057	sq. centi- meters sq. ft. (British)	925 1
1 sq. foot (British)	sq. ft.	929.029 .9999942	sq. centimeters sq. ft. (U. S.)	925 1
1 hectare	ha.	2.4710 107638.7	acres sq. ft.	2.5
1 square inch	sq. in.	6.4516	sq. centimeters	6.5
1 square kilometer	$\overline{\text{km}}^2$	247.104 .3861	acres sq. mile	250 $\frac{1}{3}$
1 sq. meter	$\overline{\text{m}}^2$	1.19599 10.7639	sq. yd. sq. ft.	$1\frac{1}{5}$ $10\frac{3}{4}$
1 square mile	sq. ml.	25900. 259. 2.59	ares hectares sq. kilometers	260 $2\frac{1}{2}$
1 sq. mil.	$\overline{\text{mil}}^2$	.0006452	sq. milli- meters sq. inches sq. inches sq. mils.	
1 sq. millimeter	$\overline{\text{mm}}^2$	.00155 1550.	sq. miles	$38\frac{2}{3}$
1 sq. myriameter		38.6101	sq. m.	$\frac{7}{8}$
1 sq. yard	sq. yd.	.83613	sq. kilometers	90
1 township		93.21 .9321 36.	myriameters sq. miles	1

Volume	Abbreviations	Equivalents	Approximate Equivalents
1 board foot	b. f.	144.	cu. in., viz. 1 sq. ft. sur- face and 1 in. thick
1 bushel (U. S.)	bu.	35239.28	cubic centi- meters
		35.2393	liters
		.35239	hectoliters
		2150.420	cubic inches
		.96897	bu. (British)
1 bushel (British)	bu.	36367.7048	cubic centi- meters
		36.3677	liters
		.36368	hectoliters
		2219.28	cubic inches
		1.032	bu. (U. S.)
1 cord	c.	4 x 4 x 8	ft.
		3.62458	steres or cubic meters
1 cu. centimeter	cc. or $\frac{\text{cm}^3}{\text{dm}^3}$	.0610234	cubic inches
1 cu. decimeter	$\frac{\text{cm}^3}{\text{dm}^3}$	61.0234	cubic inches
		.0353	cubic foot
			1 liter
1 cubic foot	ft ³ . or cu. ft.	28317.	cu. centi- meters
		28.317	liters
		.28317	hectoliter
		29.922	liquid qt. (U. S.)
		24.916	quarts (British)
		25.714	dry quarts
1 cubic inch	cu. in.	16.387	cubic centi- meters
1 cubic meter	cu. m. or m ³ .	1 stere = 10	hectoliters
		35.314	cubic feet
		28.3774	bu. (U. S.)
		27.4969	bu. (British)
		1.30794	cu. yards
		264.170	gallons (U. S.)
		219.975	gallons (British)
1 cubic yard	cu. yd.	.764559	stere or cu. meter

Volume	Abbreviations	Equivalents		Approximate Equivalents
1 cubic yard	cu. yd.	764.559	liters	760
		201.974	gallons (U. S.)	200
		168.184	gallons (British)	170
		21.6962	bu. (U. S.)	22
		21.023	bu. (British)	21
1 dram (U. S.) fluid	fl. dr.	3.6967	milliliters or cubic centi- meters	$3\frac{2}{3}$
		.22559	cu. in.	$\frac{1}{4}$
1 dram (British) fluid	fl. dr.	3.5515	milliliters or cubic centimeters	$3\frac{1}{2}$
		.2167	cu. in.	$\frac{1}{5}$
1 gallon (U. S.)	gal.	3.78543	liters	$3\frac{3}{4}$
		.8327	gallon (British)	$\frac{7}{8}$
		231 cu. in. =	8.345 lbs. water	
1 gallon (British)	gal.	4.54596	liters	$4\frac{1}{2}$
		1.2009	gal. (U. S.)	$1\frac{1}{5}$
		277.410	cu. in. = 10 lbs. water	270
1 gill (U. S.)	gi.	118.295	cu. centimeters	120
		.1183	liter	1
		7.2188	cu. in.	$7\frac{1}{5}$
1 gill (British)	gi.	142.0614	cu. centimeter	
		.14206	liter	$\frac{5}{8}$
		8.6691	cu. in.	$8\frac{2}{3}$
1 hectoliter	hl.	26.417	gallons (U. S.)	$26\frac{2}{5}$
		21.997	gal. (British)	22
		2.8377	bu. (U. S.)	$2\frac{7}{8}$
		2.7497	bu. (British)	$2\frac{3}{4}$
1 hogshead (U. S.)	hhd.	2.3848	hectoliters	$2\frac{1}{3}$
1 hogshead (British)	hhd.	2.86396	hectoliters	$2\frac{7}{8}$
1 liter	l.	61.0234	cu. in.	61
		1.05668	quarts (U. S. liquid)	1
		.8799	quarts (British)	$\frac{3}{4}$
		.9081	quart (U. S. dry)	.9
1 milliliter	ml.	1.	cu. centimeter	
1 minim (U. S.)	m.	61.612	cu. millimeters	$61\frac{2}{3}$
		.0616	milliliters	$\frac{3}{10}$
1 minim (British)	m.	59.1922	cu. millimeters	59
		.05919	milliliters	

Volume	Abbreviations	Equivalents		Approximate Equivalents
1 ounce (U. S.) fluid	fl.oz.	29.5737	cu. centimeters	29½
		1.8047	cu. in.	1 ⁴ / ₅
1 ounce (British) fluid	fl.oz.	28.4123	cu. centimeters	28 ² / ₅
		1.7338	cu. in.	1 ³ / ₄
1 peck (U. S.)	pk.	8.80982	liters	8 ¹ / ₅
		2.327	gallons (U. S.)	2 ¹ / ₃
		.96897	peck (British)	1
		537.605	cu. in.	530
		.3111	cu. ft.	¹ / ₃
1 peck (British)	pk.	9.09193	liters	9.1
		1.032	pecks (U. S.)	1
		554.82	cu. in.	550
		.3211	cu. ft.	¹ / ₃
1 perch	p.	16½ x 1½ x 1 ft. (masonry)		
		.7	stere or cu. meter	
1 pint (U. S.) liquid	pt.	.4732	liter	1 ⁰ / ₂₁
		4.7318	deciliters	4 ³ / ₄
		28.875	cu. in.	28 ⁷ / ₈
		.8594	pint (U. S. dry)	⁷ / ₈
		.8327	pint (British)	⁷ / ₈
1 pint (U. S.) dry	pt.	.5506	liter	1 ¹ / ₂₀
		33.600	cu. in.	33 ² / ₃
		1.1637	pints (U. S. liquid)	1 ¹ / ₆
		.96897	pints (British)	1
1 pint (British)	pt.	.5682	liter	4 ⁷ / ₇
		34.6762	cu. in.	34 ² / ₃
		1.2009	pints (U. S. liquid)	1 ¹ / ₅
1 quart (U. S.) liquid	qt.	.94636	liter	1
		57.750	cu. in. = 2.086 lbs. water	57 ³ / ₄
		.8594	quart (U. S. dry)	⁷ / ₈
		.8327	quart (British)	⁷ / ₈
1 quart (U. S.) dry	qt.	1.10123	liters	1.1

Volume	Abbreviations	Equivalents		Approximate Equivalents
1 quart (U. S.) dry	qt.	67.2006	cu. in.	$67\frac{1}{5}$
		1.1637	quarts (U. S. liquid)	$1\frac{1}{6}$
		.96897	quarts (British)	1
1 quart (British)	qt.	1.1365	liters	$1\frac{1}{8}$
		69.3525	cu. in.	$69\frac{1}{3}$
		1.2009	quarts (U. S. liquid)	$1\frac{1}{5}$
1 stere	s.	1.	cubic meter	

Weights or Masses	Abbreviations	Equivalents		Equivalents
1 carat	c.	3.1714	grains	$3\frac{1}{6}$
		205.500	milligrams	
1 centigram	cg.	.15432	grain	$\frac{2}{13}$
1 decigram	dg.	1.54324	grain	$1\frac{1}{2}$
1 dekagram or decagram	dg.	.35276	oz. (av.)	$\frac{1}{3}$
1 dram (ap.)	3	3.887934	grams	$3\frac{7}{8}$
		2.19429	drams (av.)	$2\frac{1}{5}$
1 dram (av.)	dr.	1.77185	grams	$1\frac{3}{4}$
		.45573	drams (ap.)	$\frac{5}{11}$
1 grain	gr.	64.7989	milligram	$64\frac{3}{4}$
1 gram	g.	15.4323564	grains	$15\frac{5}{11}$
		.035274	oz. (av.)	
		.032151	oz. (Troy)	
1 hundredweight (long)	cwt.	50.8024	kilograms	$50\frac{1}{5}$
1 hundredweight (short)	cwt.	45.35924	kilograms	$45\frac{1}{3}$
1 kilogram	kg.	2.20462	pounds (av.)	$2\frac{1}{5}$
		2.67923	pounds (Troy)	$2\frac{2}{3}$
1 metric ton	t.	2204.62	pounds (av.)	2200
		1.1023	net tons	1.1
1 milligram	mg.	.015432	grain	
1 ounce (apothecaries')	\mathfrak{z}	31.1035	grams	31.1
		1.09714	oz. (av.)	1.1
		1.	oz. (Troy)	
1 ounce (avoirdupois)	oz.	28.3495	grams	$28\frac{1}{3}$
		.911458	oz. (Troy)	.9

Weights or Masses	Abbreviations	Equivalents		Approximate Equivalents
1 ounce (Troy)	oz.	31.1035	grams	31.1
		1.09714	oz. (av.)	1.1
		1	oz. (ap.)	
1 pennyweight	dwt.	1.55517	grams	1½
1 pound (av.)	lb.	453.592428	grams	450.
		.45359	kilogram	$\frac{9}{20}$
		1.21528	lb. (Troy)	$1\frac{1}{5}$
		14.5833	oz. (Troy)	$1\frac{0.0}{7}$
		7000.	grains	
1 pound (Troy)	lb.	373.242	grams	373¼
		.822857	pound (av.)	$\frac{5}{6}$
		5760.	grains	
1 quarter	qr.	11.3398	kilograms	11⅓
		25.	pounds (av.)	
1 scruple	℥	1.295978	grams	1⅓
1 ton (net or short)	tn. or t.	907.185	kilograms	900
		.907185	metric ton	.9
1 ton (long or gross)	tn. or t.	1016.05	kilograms	1000
		1.016	metric tons	
1 tonne or tonneau	t.	1	metric ton	

DIRECTIONS FOR USING TABLES

Pages 151-173

To determine the volume of any cylindrical measure, find its diameter and depth. Find the column headed with the number corresponding with the diameter and then in this column find the number opposite a row corresponding with the depth. This number indicates the cubical contents.

Illustration: Suppose a measure has a diameter of $8\frac{1}{8}$ inches and a depth of $10\frac{3}{8}$ inches. Find the column (see page 129) headed $8\frac{1}{8}$, then pass down the column till opposite $10\frac{3}{8}$, and there is found 537.93. This is the contents of the measure, namely 537.93 cubic inches. Or, if the measurement had been made in centimeters, the contents would be cubic centimeters. If the measurement had been made in decimeters, the contents would be 537.93 cubic decimeters or liters.

The sealer will soon become familiar with the cubical contents of the customary measures. They are found in the table of equivalents on pages 142 to 149.

Having determined the contents, the allowable error or tolerance should be looked up on pages 134 to 137, and the measure accepted or condemned accordingly.

Height	DIAMETER							
	2	2 $\frac{1}{8}$	2 $\frac{1}{4}$	2 $\frac{3}{8}$	2 $\frac{1}{2}$	2 $\frac{5}{8}$	2 $\frac{3}{4}$	2 $\frac{7}{8}$
2 $\frac{1}{2}$	7.85	8.87	9.94	11.08	12.27	13.53	14.85	16.23
2 $\frac{5}{8}$	8.25	9.31	10.44	11.62	12.89	14.20	15.59	17.04
2 $\frac{3}{4}$	8.64	9.75	10.93	12.18	13.60	14.88	16.33	17.85
2 $\frac{7}{8}$	9.03	10.20	11.43	12.73	14.11	15.56	17.08	18.66
3	9.42	10.64	11.93	13.29	14.73	16.24	17.82	19.48
3 $\frac{1}{8}$	9.82	11.08	12.42	13.84	15.34	16.91	18.56	20.29
3 $\frac{1}{4}$	10.21	11.53	12.92	14.40	15.95	17.59	19.30	21.10
3 $\frac{3}{8}$	10.60	11.97	13.42	14.95	16.57	18.27	20.05	21.91
3 $\frac{1}{2}$	10.995	12.41	13.92	15.51	17.18	18.94	20.79	22.72
3 $\frac{5}{8}$	11.39	12.86	14.41	16.06	17.79	19.62	21.53	23.53
3 $\frac{3}{4}$	11.78	13.30	14.91	16.61	18.41	20.29	22.27	24.34
3 $\frac{7}{8}$	12.17	13.74	15.40	17.17	19.02	20.97	23.02	25.16
4	12.57	14.19	15.90	17.72	19.64	21.65	23.76	25.97
4 $\frac{1}{8}$	12.96	14.63	16.40	18.27	20.25	22.32	24.50	26.78
4 $\frac{1}{4}$	13.35	15.07	16.90	18.83	20.86	23.00	25.24	27.59
4 $\frac{3}{8}$	13.74	15.51	17.40	19.38	21.48	23.68	25.99	28.40
4 $\frac{1}{2}$	14.14	15.96	17.89	19.94	22.09	24.35	26.73	29.22
4 $\frac{5}{8}$	14.53	16.49	18.39	20.49	22.70	25.03	27.47	30.03
4 $\frac{3}{4}$	14.92	16.85	18.89	21.04	23.32	25.71	28.21	30.84
4 $\frac{7}{8}$	15.32	17.29	19.38	21.60	23.93	26.38	28.96	31.65
5	15.71	17.73	19.88	22.15	24.54	27.06	29.70	32.46
5 $\frac{1}{8}$	16.10	18.18	20.38	22.70	25.16	27.74	30.44	33.27
5 $\frac{1}{4}$	16.49	18.62	20.87	23.26	25.77	28.41	31.18	34.08
5 $\frac{3}{8}$	16.89	19.06	21.37	23.81	26.38	29.09	31.92	34.89
5 $\frac{1}{2}$	17.28	19.51	21.87	24.37	27.00	29.76	32.67	35.70
5 $\frac{5}{8}$	17.67	19.95	22.37	24.92	27.61	30.44	33.41	36.52
5 $\frac{3}{4}$	18.06	20.39	22.86	25.47	28.23	31.12	34.15	37.33
5 $\frac{7}{8}$	18.46	20.84	23.36	26.03	28.84	31.79	34.89	38.14
6	18.85	21.28	23.86	26.58	29.45	32.47	35.64	38.95
6 $\frac{1}{8}$	19.24	21.72	24.35	27.13	30.07	33.15	36.38	39.76
6 $\frac{1}{4}$	19.64	22.17	24.95	27.69	30.68	33.82	37.12	40.57
6 $\frac{3}{8}$	20.03	22.61	25.45	28.24	31.29	34.50	37.86	41.39
6 $\frac{1}{2}$	20.42	23.05	25.94	28.80	31.91	35.18	38.60	42.20
6 $\frac{5}{8}$	20.81	23.50	26.44	29.35	32.52	35.85	39.35	43.01
6 $\frac{3}{4}$	21.21	23.94	26.94	29.90	33.13	36.53	40.09	43.82
6 $\frac{7}{8}$	21.60	24.38	27.34	30.46	33.75	37.21	40.83	44.63
7	21.99	24.83	27.83	31.01	34.36	37.88	41.58	45.44
7 $\frac{1}{8}$	22.38	25.27	28.33	31.56	34.97	38.56	42.32	46.25
7 $\frac{1}{4}$	22.78	25.71	28.83	32.12	35.59	39.24	43.06	47.07

Height	DIAMETER							
	2	2 $\frac{1}{8}$	2 $\frac{1}{4}$	2 $\frac{3}{8}$	2 $\frac{1}{2}$	2 $\frac{5}{8}$	2 $\frac{3}{4}$	2 $\frac{7}{8}$
7 $\frac{3}{8}$	23.17	26.16	29.32	32.67	36.20	39.91	43.80	47.88
7 $\frac{1}{2}$	23.56	26.60	29.82	33.23	36.82	40.59	44.55	48.69
7 $\frac{5}{8}$	23.95	27.04	30.32	33.79	37.43	41.26	45.29	49.50
7 $\frac{3}{4}$	24.35	27.49	30.81	34.33	38.04	41.94	46.03	50.31
7 $\frac{7}{8}$	24.74	27.93	31.31	34.89	38.66	42.62	46.77	51.12
8	25.13	28.37	31.81	35.44	39.27	43.29	47.52	51.93
8 $\frac{1}{8}$	25.52	28.82	32.31	35.99	39.88	43.97	48.26	52.75
8 $\frac{1}{4}$	25.92	29.26	32.80	36.55	40.50	44.65	49.00	53.56
8 $\frac{3}{8}$	26.31	29.70	33.30	37.10	41.11	45.32	49.74	54.37
8 $\frac{1}{2}$	26.70	30.15	33.80	37.66	41.72	46.00	50.49	55.18
8 $\frac{5}{8}$	27.10	30.59	34.29	38.21	42.34	46.68	51.23	55.99
8 $\frac{3}{4}$	27.49	31.03	34.79	38.76	42.95	47.35	51.97	56.80
8 $\frac{7}{8}$	27.88	31.48	35.29	39.32	43.57	48.03	52.71	57.61
9	28.27	31.92	35.78	39.87	44.18	48.71	53.46	58.43
9 $\frac{1}{8}$	28.67	32.36	36.28	40.42	44.79	49.38	54.20	59.24
9 $\frac{1}{4}$	29.06	32.81	36.78	40.98	45.41	50.06	54.94	60.05
9 $\frac{3}{8}$	29.45	33.25	37.28	41.53	46.02	50.74	55.68	60.86
9 $\frac{1}{2}$	29.85	33.69	37.77	42.09	46.63	51.41	56.43	61.67
9 $\frac{5}{8}$	30.24	34.14	38.27	42.64	47.25	52.09	57.17	62.48
9 $\frac{3}{4}$	30.63	34.58	38.77	43.19	47.86	52.77	57.91	63.30
9 $\frac{7}{8}$	31.02	35.02	39.26	43.75	48.47	53.44	58.65	64.11
10	31.42	35.465	39.76	44.30	49.09	54.12	59.40	64.92
10 $\frac{1}{8}$	31.81	35.91	40.26	44.85	49.70	54.79	60.14	65.73
10 $\frac{1}{4}$	32.20	36.35	40.76	45.41	50.32	55.47	60.88	66.54
10 $\frac{3}{8}$	32.59	36.79	41.25	45.96	50.93	56.15	61.62	67.35
10 $\frac{1}{2}$	32.99	37.24	41.75	46.52	51.54	56.82	62.36	68.16
10 $\frac{5}{8}$	33.38	37.68	42.25	47.07	52.16	57.50	63.11	68.98
10 $\frac{3}{4}$	33.77	38.12	42.74	47.62	52.77	58.18	63.85	69.79
10 $\frac{7}{8}$	34.16	38.57	43.24	48.18	53.38	58.85	64.59	70.60
11	34.56	39.01	43.74	48.73	54.00	59.53	65.33	71.41
11 $\frac{1}{8}$	34.95	39.45	44.23	49.28	54.61	60.21	66.08	72.22
11 $\frac{1}{4}$	35.34	39.90	44.73	49.83	55.22	60.88	66.82	73.03
11 $\frac{3}{8}$	35.74	40.34	45.23	50.39	55.84	61.56	67.56	73.84
11 $\frac{1}{2}$	36.13	40.78	45.73	50.95	56.45	62.24	68.30	74.66
12 $\frac{5}{8}$	36.52	41.23	46.22	51.50	57.06	62.91	69.05	75.47
11 $\frac{3}{4}$	36.91	41.67	46.72	52.05	57.68	63.59	69.79	76.28
11 $\frac{7}{8}$	37.31	42.11	47.22	52.60	58.29	64.27	70.53	77.09
12	37.70	42.56	47.71	53.16	58.91	64.94	71.27	77.90

Height	DIAMETER							
	3	3 $\frac{1}{8}$	3 $\frac{1}{4}$	3 $\frac{3}{8}$	3 $\frac{1}{2}$	3 $\frac{5}{8}$	3 $\frac{3}{4}$	3 $\frac{7}{8}$
2 $\frac{1}{2}$	17.67	19.17	20.74	22.37	24.05	25.80	27.61	29.48
2 $\frac{3}{8}$	18.56	20.13	21.78	23.48	25.25	27.09	28.99	30.96
2 $\frac{1}{4}$	19.44	21.09	22.81	24.60	26.46	28.38	30.37	32.43
2 $\frac{7}{8}$	20.32	22.05	23.85	25.72	27.66	29.67	31.75	33.91
3	21.21	23.01	24.89	26.84	28.86	30.96	33.13	35.38
3 $\frac{1}{8}$	22.09	23.97	25.92	27.96	30.07	32.25	34.51	36.85
3 $\frac{1}{4}$	22.97	24.93	26.96	29.07	31.27	33.54	35.89	38.33
3 $\frac{3}{8}$	23.86	25.88	28.00	30.19	32.47	34.83	37.27	39.80
3 $\frac{1}{2}$	24.74	26.84	29.03	31.31	33.67	36.12	38.65	41.28
3 $\frac{5}{8}$	25.62	27.80	30.07	32.43	34.88	37.41	40.03	42.75
3 $\frac{3}{4}$	26.51	28.76	31.11	33.55	36.08	38.70	41.42	44.22
3 $\frac{7}{8}$	27.39	29.72	32.15	34.67	37.28	39.99	42.80	45.70
4	28.28	30.68	33.18	35.78	38.48	41.28	44.18	47.17
4 $\frac{1}{8}$	29.16	31.64	34.22	36.90	39.69	42.57	45.56	48.65
4 $\frac{1}{4}$	30.04	32.60	35.26	38.02	40.89	43.86	46.94	50.12
4 $\frac{3}{8}$	30.93	33.55	36.29	39.14	42.09	45.15	48.32	51.60
4 $\frac{1}{2}$	31.81	34.51	37.33	40.26	43.29	46.44	49.70	53.07
4 $\frac{5}{8}$	32.69	35.47	38.37	41.38	44.50	47.73	51.08	54.53
4 $\frac{3}{4}$	33.58	36.43	39.40	42.49	45.70	49.02	52.46	56.01
4 $\frac{7}{8}$	34.46	37.39	40.44	43.61	46.90	50.31	53.84	57.48
5	35.34	38.35	41.48	44.73	48.11	51.60	55.22	58.97
5 $\frac{1}{8}$	36.23	39.31	42.52	45.85	49.31	52.89	56.60	60.44
5 $\frac{1}{4}$	37.11	40.27	43.55	46.97	50.51	54.18	57.98	61.91
5 $\frac{3}{8}$	37.99	41.23	44.59	48.08	51.71	55.47	59.36	63.39
5 $\frac{1}{2}$	38.88	42.18	45.63	49.20	52.92	56.76	60.75	64.86
5 $\frac{5}{8}$	39.76	43.14	46.66	50.32	54.12	58.05	62.13	66.34
5 $\frac{3}{4}$	40.64	44.10	47.70	51.44	55.32	59.34	63.51	67.81
5 $\frac{7}{8}$	41.53	45.06	48.74	52.56	56.52	60.63	64.89	69.29
6	42.41	46.02	49.77	53.68	57.73	61.92	66.27	70.76
6 $\frac{1}{8}$	43.30	46.98	50.81	54.79	58.93	63.21	67.65	72.23
6 $\frac{1}{4}$	44.18	47.94	51.85	55.91	60.13	64.50	69.03	73.71
6 $\frac{3}{8}$	45.06	48.90	52.89	57.03	61.33	65.79	70.41	75.18
6 $\frac{1}{2}$	45.95	49.85	53.92	58.15	62.54	67.08	71.79	76.66
6 $\frac{5}{8}$	46.83	50.81	54.96	59.27	63.74	68.37	73.17	78.13
6 $\frac{3}{4}$	47.71	51.77	56.00	60.39	64.94	69.66	74.55	79.60
6 $\frac{7}{8}$	48.60	52.73	57.03	61.50	66.15	70.95	75.93	81.08
7	49.48	53.69	58.07	62.62	67.35	72.24	77.31	82.55
7 $\frac{1}{8}$	50.36	54.65	59.11	63.74	68.55	73.53	78.69	84.03
7 $\frac{1}{4}$	51.25	55.61	60.14	64.86	69.75	74.82	80.07	85.50

Height	DIAMETER							
	3	3 $\frac{1}{8}$	3 $\frac{1}{4}$	3 $\frac{3}{8}$	3 $\frac{1}{2}$	3 $\frac{5}{8}$	3 $\frac{3}{4}$	3 $\frac{7}{8}$
7 $\frac{3}{8}$	52.13	56.57	61.18	65.98	70.96	76.11	81.45	86.97
7 $\frac{1}{2}$	53.01	57.52	62.22	67.10	72.16	77.40	82.83	88.45
7 $\frac{5}{8}$	53.90	58.48	63.26	68.22	73.36	78.69	84.22	89.92
7 $\frac{3}{4}$	54.78	59.44	64.29	69.33	74.56	79.98	85.60	91.40
7 $\frac{7}{8}$	55.67	60.40	65.33	70.45	75.77	81.27	86.98	92.87
8	56.55	61.36	66.37	71.57	76.97	82.56	88.36	94.35
8 $\frac{1}{8}$	57.43	62.32	67.40	72.67	78.17	83.85	89.74	95.82
8 $\frac{1}{4}$	58.32	63.28	68.44	73.81	79.37	85.14	91.12	97.29
8 $\frac{3}{8}$	59.20	64.24	69.48	74.93	80.58	86.43	92.50	98.77
8 $\frac{1}{2}$	60.08	65.19	70.51	76.04	81.78	87.72	93.88	100.24
8 $\frac{5}{8}$	60.97	66.15	71.54	77.16	82.98	89.01	95.26	101.72
8 $\frac{3}{4}$	61.85	67.11	72.59	78.28	84.18	90.30	96.64	103.19
8 $\frac{7}{8}$	62.73	68.07	73.63	79.40	85.39	91.59	98.02	104.66
9	63.62	69.03	74.66	80.51	86.59	92.89	99.40	106.14
9 $\frac{1}{8}$	64.50	69.99	75.70	81.63	87.79	94.18	100.78	107.61
9 $\frac{1}{4}$	65.39	70.95	76.74	82.75	89.00	95.47	102.16	109.09
9 $\frac{3}{8}$	66.27	71.91	77.77	83.87	90.20	96.76	103.54	110.56
9 $\frac{1}{2}$	67.15	72.86	78.80	84.99	91.40	98.05	104.92	112.04
9 $\frac{5}{8}$	68.04	73.82	79.84	86.11	92.60	99.34	106.30	113.51
9 $\frac{3}{4}$	68.92	74.78	80.88	87.23	93.81	100.63	107.68	114.98
9 $\frac{7}{8}$	69.70	75.74	81.92	88.35	95.01	101.92	109.07	116.46
10	70.69	76.70	82.96	89.46	96.21	103.21	110.45	117.93
10 $\frac{1}{8}$	71.57	77.66	84.00	90.58	97.41	104.50	111.83	119.41
10 $\frac{1}{4}$	72.45	78.62	85.03	91.70	98.62	105.79	113.21	120.88
10 $\frac{3}{8}$	73.34	79.58	86.07	92.82	99.82	107.08	114.59	122.35
10 $\frac{1}{2}$	74.22	80.53	87.11	93.94	101.02	108.37	115.97	123.83
10 $\frac{5}{8}$	75.10	81.49	88.14	95.06	102.22	109.66	117.35	125.30
10 $\frac{3}{4}$	75.99	82.45	89.18	96.17	103.43	110.95	118.73	126.78
10 $\frac{7}{8}$	76.87	83.41	90.22	97.29	104.63	112.24	120.11	128.25
11	77.75	84.37	91.25	98.41	105.83	113.53	121.49	129.73
11 $\frac{1}{8}$	78.64	85.33	92.29	99.53	107.03	114.82	122.87	131.20
11 $\frac{1}{4}$	79.52	86.29	93.33	100.65	108.24	116.11	124.25	132.67
11 $\frac{3}{8}$	80.41	87.25	94.37	101.77	109.44	117.40	125.63	134.15
11 $\frac{1}{2}$	81.29	88.20	95.40	102.88	110.64	118.69	127.01	135.62
11 $\frac{5}{8}$	82.17	89.16	96.44	104.00	111.84	119.98	128.39	137.10
11 $\frac{3}{4}$	83.06	90.12	97.48	105.12	113.05	121.27	129.77	138.57
11 $\frac{7}{8}$	83.94	91.08	98.51	106.24	114.25	122.56	131.15	140.05
12	84.83	92.04	99.55	107.35	115.45	123.85	132.54	141.52

Height	DIAMETER							
	4	4 $\frac{1}{8}$	4 $\frac{1}{4}$	4 $\frac{3}{8}$	4 $\frac{1}{2}$	4 $\frac{5}{8}$	4 $\frac{3}{4}$	4 $\frac{7}{8}$
2 $\frac{1}{2}$	31.42	33.41	35.47	37.58	39.76	42.00	44.30	46.66
2 $\frac{5}{8}$	32.99	35.08	37.24	39.46	41.75	44.10	46.52	49.00
2 $\frac{3}{4}$	34.56	36.75	39.01	41.34	43.74	46.20	48.73	51.33
2 $\frac{7}{8}$	36.13	38.42	40.79	43.22	45.72	48.30	50.95	53.66
3	37.70	40.09	42.56	45.10	47.71	50.40	53.16	56.00
3 $\frac{1}{8}$	39.27	41.76	44.33	46.98	49.70	52.50	55.38	58.33
3 $\frac{1}{4}$	40.84	43.43	46.11	48.86	51.69	54.60	57.59	60.66
3 $\frac{3}{8}$	42.41	45.10	47.88	50.74	53.68	56.70	59.81	63.00
3 $\frac{1}{2}$	43.98	46.77	49.65	52.62	55.67	58.80	62.02	65.33
3 $\frac{5}{8}$	45.55	48.44	51.43	54.49	57.65	60.90	64.24	67.66
3 $\frac{3}{4}$	47.12	50.12	53.20	56.37	59.64	63.00	66.45	70.00
3 $\frac{7}{8}$	48.69	51.79	54.97	58.25	61.63	65.10	68.67	72.33
4	50.27	53.46	56.75	60.13	63.62	67.20	70.88	74.66
4 $\frac{1}{8}$	51.84	55.13	58.52	62.01	65.61	69.30	73.10	77.00
4 $\frac{1}{4}$	53.41	56.80	60.29	63.89	67.59	71.40	75.31	79.33
4 $\frac{3}{8}$	54.98	58.47	62.07	65.77	69.58	73.50	77.53	81.66
4 $\frac{1}{2}$	56.55	60.14	63.84	67.65	71.57	75.60	79.74	83.99
4 $\frac{5}{8}$	58.12	61.81	65.61	69.53	73.56	77.70	81.96	86.33
4 $\frac{3}{4}$	59.69	63.48	67.38	71.41	75.55	79.80	84.17	88.66
4 $\frac{7}{8}$	61.26	65.15	69.16	73.29	77.53	81.90	86.39	90.99
5	62.83	66.82	70.93	75.17	79.52	84.00	88.60	93.33
5 $\frac{1}{8}$	64.40	68.49	72.70	77.04	81.51	86.10	90.82	95.66
5 $\frac{1}{4}$	65.97	70.16	74.48	78.92	83.50	88.20	93.03	97.99
5 $\frac{3}{8}$	67.54	71.83	76.25	80.80	85.49	90.30	95.25	100.33
5 $\frac{1}{2}$	69.12	73.50	78.02	82.68	87.47	92.40	97.46	102.66
5 $\frac{5}{8}$	70.69	75.17	79.80	84.56	89.46	94.50	99.68	104.99
5 $\frac{3}{4}$	72.26	76.84	81.57	86.44	91.45	96.60	101.89	107.33
5 $\frac{7}{8}$	73.83	78.51	83.34	88.32	93.44	98.70	104.11	109.66
6	75.40	80.18	85.12	90.20	95.43	100.80	106.32	111.99
6 $\frac{1}{8}$	76.97	81.85	86.89	92.08	97.41	102.90	108.54	114.33
6 $\frac{1}{4}$	78.54	83.53	88.66	93.96	99.40	105.00	110.75	116.66
6 $\frac{3}{8}$	80.11	85.20	90.44	95.83	101.39	107.10	112.97	118.99
6 $\frac{1}{2}$	81.68	86.87	92.21	97.71	103.38	109.20	115.18	121.33
6 $\frac{5}{8}$	83.25	88.54	93.98	99.59	105.37	111.30	117.40	123.66
6 $\frac{3}{4}$	84.82	90.21	95.76	101.47	107.35	113.40	119.61	125.99
6 $\frac{7}{8}$	86.39	91.88	97.53	103.35	109.34	115.50	121.83	128.33
7	87.96	93.55	99.30	105.23	111.33	117.60	124.04	130.66
7 $\frac{1}{8}$	89.54	95.22	101.08	107.11	113.32	119.70	126.26	132.99
7 $\frac{1}{4}$	91.11	96.89	102.85	108.99	115.31	121.80	128.47	135.33

Depth	DIAMETER							
	4	4 $\frac{1}{8}$	4 $\frac{1}{4}$	4 $\frac{3}{8}$	4 $\frac{1}{2}$	4 $\frac{5}{8}$	4 $\frac{3}{4}$	4 $\frac{7}{8}$
7 $\frac{3}{8}$	92.68	98.56	104.63	110.87	117.29	123.90	130.69	137.66
7 $\frac{1}{2}$	94.25	100.23	106.40	112.75	119.28	126.00	132.90	139.99
7 $\frac{5}{8}$	95.82	101.90	108.17	114.63	121.27	128.10	135.12	142.32
7 $\frac{3}{4}$	97.39	103.57	109.94	116.50	123.26	130.20	137.33	144.66
7 $\frac{7}{8}$	98.96	105.24	111.72	118.38	125.25	132.30	139.55	146.99
8	100.53	106.91	113.49	120.26	127.23	134.40	141.76	149.32
8 $\frac{1}{8}$	102.10	108.58	115.26	122.14	129.22	136.50	143.98	151.66
8 $\frac{1}{4}$	103.67	110.25	117.04	124.02	131.21	138.60	146.19	153.99
8 $\frac{3}{8}$	105.24	111.92	118.81	125.90	133.20	140.70	148.41	156.32
8 $\frac{1}{2}$	106.81	113.59	120.58	127.78	135.19	142.80	150.62	158.66
8 $\frac{5}{8}$	108.39	115.26	122.36	129.66	137.18	144.90	152.84	160.99
8 $\frac{3}{4}$	109.96	116.94	124.13	131.54	139.16	147.00	155.05	163.32
8 $\frac{7}{8}$	111.53	118.61	125.90	133.41	141.15	149.10	157.27	165.66
9	113.10	120.28	127.68	135.30	143.14	151.20	159.48	167.99
9 $\frac{1}{8}$	114.67	121.95	129.45	137.18	145.13	153.30	161.70	170.32
9 $\frac{1}{4}$	116.24	123.62	131.22	139.06	147.12	155.40	163.91	172.66
9 $\frac{3}{8}$	117.81	125.29	133.00	140.93	149.10	157.50	166.13	174.99
9 $\frac{1}{2}$	119.38	126.96	134.77	142.81	151.09	159.60	168.34	177.32
9 $\frac{5}{8}$	120.95	128.63	136.54	144.69	153.08	161.70	170.56	179.66
9 $\frac{3}{4}$	122.52	130.30	138.32	146.57	155.07	163.80	172.77	181.99
9 $\frac{7}{8}$	124.09	131.97	140.09	148.45	157.06	165.90	174.99	184.32
10	125.66	133.64	141.86	150.33	159.04	168.00	177.20	186.66
10 $\frac{1}{8}$	127.23	135.31	143.64	152.21	161.03	170.10	179.42	188.99
10 $\frac{1}{4}$	128.81	136.98	145.41	154.09	163.02	172.20	181.63	191.32
10 $\frac{3}{8}$	130.38	138.65	147.18	155.97	165.01	174.30	183.85	193.65
10 $\frac{1}{2}$	131.95	140.32	148.96	157.85	167.00	176.40	186.06	195.99
10 $\frac{5}{8}$	133.52	141.99	150.73	159.73	168.99	178.50	188.28	198.32
10 $\frac{3}{4}$	135.09	143.66	152.50	161.60	170.97	180.60	190.49	200.65
10 $\frac{7}{8}$	136.66	145.33	154.28	163.48	172.96	182.70	192.71	202.99
11	138.23	147.00	156.05	165.36	174.95	184.80	194.92	205.32
11 $\frac{1}{8}$	139.80	148.67	157.82	167.24	176.94	186.90	197.14	207.65
11 $\frac{1}{4}$	141.37	150.35	159.60	169.12	178.93	189.00	199.35	209.99
11 $\frac{3}{8}$	142.94	152.02	161.37	171.00	180.91	191.10	201.57	212.32
11 $\frac{1}{2}$	144.51	153.69	163.14	172.88	182.90	193.20	203.78	214.65
11 $\frac{5}{8}$	146.08	155.36	164.92	174.76	184.88	195.30	206.00	216.99
11 $\frac{3}{4}$	147.66	157.03	166.69	176.64	186.87	197.40	208.21	219.32
11 $\frac{7}{8}$	149.23	158.70	168.46	178.52	188.86	199.50	210.43	221.65
12	150.80	160.37	170.24	180.40	190.85	201.60	212.64	223.99

Depth	DIAMETER							
	5	5 $\frac{1}{8}$	5 $\frac{1}{4}$	5 $\frac{3}{8}$	5 $\frac{1}{2}$	5 $\frac{5}{8}$	5 $\frac{3}{4}$	5 $\frac{7}{8}$
2 $\frac{1}{2}$	49.08	51.57	54.12	56.73	59.40	62.13	64.92	67.77
2 $\frac{5}{8}$	51.54	54.15	56.82	59.56	62.37	65.23	68.16	71.16
2 $\frac{3}{4}$	54.00	56.73	59.53	62.40	65.34	68.34	71.41	74.55
2 $\frac{7}{8}$	56.45	59.31	62.24	65.24	68.31	71.45	74.66	77.94
3	58.91	61.89	64.94	68.07	71.28	74.55	77.90	81.33
3 $\frac{1}{8}$	61.36	64.47	67.65	70.91	74.24	77.66	81.15	84.71
3 $\frac{1}{4}$	63.81	67.04	70.35	73.74	77.21	80.76	84.39	88.10
3 $\frac{3}{8}$	66.27	69.62	73.06	76.58	80.18	83.87	87.64	91.49
3 $\frac{1}{2}$	68.72	72.20	75.76	79.42	83.15	86.98	90.89	94.88
3 $\frac{5}{8}$	71.18	74.78	78.47	82.25	86.12	90.08	94.13	98.27
3 $\frac{3}{4}$	73.63	77.36	81.18	85.09	89.09	93.19	97.38	101.66
3 $\frac{7}{8}$	76.09	79.94	83.88	87.93	92.06	96.20	100.62	105.05
4	78.54	82.52	86.59	90.76	95.03	99.40	103.87	108.43
4 $\frac{1}{8}$	80.99	85.09	89.30	93.60	98.00	102.51	107.12	111.82
4 $\frac{1}{4}$	83.45	87.67	92.00	96.44	100.97	105.61	110.36	115.21
4 $\frac{3}{8}$	85.90	90.25	94.71	99.27	103.94	108.72	113.61	118.60
4 $\frac{1}{2}$	88.36	92.83	97.41	102.61	106.91	111.83	116.85	121.99
4 $\frac{5}{8}$	90.81	95.41	100.12	104.94	109.88	114.93	120.10	125.38
4 $\frac{3}{4}$	93.27	97.99	102.83	107.78	112.85	118.04	123.34	128.77
4 $\frac{7}{8}$	95.72	100.57	105.53	110.62	115.82	121.15	126.59	132.15
5	98.18	103.15	108.24	113.45	118.79	124.25	129.84	135.54
5 $\frac{1}{8}$	100.63	105.72	110.94	116.29	121.76	127.36	133.08	138.93
5 $\frac{1}{4}$	103.08	108.30	113.65	119.13	124.73	130.47	136.33	142.32
5 $\frac{3}{8}$	105.54	110.88	116.36	121.96	127.70	133.57	139.57	145.71
5 $\frac{1}{2}$	107.99	113.46	119.06	124.80	130.67	136.68	142.82	149.10
5 $\frac{3}{4}$	110.45	116.04	121.76	127.64	133.64	139.78	146.07	152.49
5 $\frac{7}{8}$	112.90	118.62	124.47	130.47	136.61	142.89	149.31	155.87
6	115.36	121.20	127.18	133.31	139.58	146.00	152.56	159.26
6 $\frac{1}{8}$	117.81	123.77	129.90	136.14	142.55	149.10	155.80	162.65
6 $\frac{1}{4}$	120.26	126.35	132.59	138.98	145.52	152.21	159.05	166.04
6 $\frac{3}{8}$	122.72	128.93	135.30	141.82	148.49	155.32	162.30	169.43
6 $\frac{1}{2}$	125.17	131.51	138.00	144.66	151.46	158.42	165.54	172.82
6 $\frac{3}{4}$	127.63	134.09	140.71	147.49	154.43	161.53	168.79	176.21
6 $\frac{7}{8}$	130.08	136.67	143.42	150.33	157.40	164.63	172.03	179.59
7	132.54	139.25	146.12	153.16	160.37	167.74	175.28	182.98
7 $\frac{1}{8}$	134.99	141.82	148.83	156.00	163.34	170.85	178.53	186.37
7 $\frac{1}{4}$	137.45	144.40	151.53	158.84	166.31	173.95	181.77	189.76
7 $\frac{3}{8}$	139.90	146.98	154.24	161.67	169.28	177.06	185.02	193.15
7 $\frac{1}{2}$	142.35	149.56	156.95	164.51	172.25	180.16	188.26	196.55

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Depth	5	5 $\frac{1}{8}$	5 $\frac{1}{4}$	5 $\frac{3}{8}$	5 $\frac{1}{2}$	5 $\frac{5}{8}$	5 $\frac{3}{4}$	5 $\frac{7}{8}$
7 $\frac{3}{8}$	144.81	152.14	159.65	167.34	175.22	183.27	191.51	199.93
7 $\frac{1}{2}$	147.26	154.72	162.36	170.18	178.19	186.38	194.75	203.31
7 $\frac{5}{8}$	149.72	157.30	165.06	173.02	181.16	189.48	198.00	206.70
7 $\frac{3}{4}$	152.17	159.87	167.77	175.85	184.13	192.59	201.25	210.09
7 $\frac{7}{8}$	154.63	162.45	170.47	178.69	187.10	195.69	204.49	213.48
8	157.08	165.03	173.18	181.53	190.07	198.80	207.74	216.87
8 $\frac{1}{8}$	159.53	167.61	175.89	184.36	193.04	201.91	210.98	220.26
8 $\frac{1}{4}$	161.99	170.19	178.59	187.20	196.01	205.01	214.23	223.65
8 $\frac{3}{8}$	164.44	172.77	181.30	190.03	198.98	208.12	217.48	227.03
8 $\frac{1}{2}$	166.90	175.35	184.00	192.87	201.95	211.22	220.72	230.42
8 $\frac{5}{8}$	169.35	177.93	186.71	195.71	204.92	214.33	223.97	233.81
8 $\frac{3}{4}$	171.81	180.50	189.42	198.54	207.89	217.44	227.21	237.20
8 $\frac{7}{8}$	174.26	183.08	192.12	201.38	210.86	220.54	230.46	240.59
9	176.72	185.66	194.83	204.22	213.83	223.65	233.71	243.98
9 $\frac{1}{8}$	179.17	188.24	197.53	207.05	216.79	226.76	236.95	247.37
9 $\frac{1}{4}$	181.62	190.82	200.24	209.89	219.76	229.87	240.20	250.75
9 $\frac{3}{8}$	184.08	193.40	202.95	212.73	222.73	232.97	243.44	254.14
9 $\frac{1}{2}$	186.53	195.98	205.65	215.56	225.70	236.08	246.69	257.53
9 $\frac{5}{8}$	188.99	198.55	208.36	218.40	228.67	239.19	249.94	260.92
9 $\frac{3}{4}$	191.44	201.13	211.06	221.23	231.64	242.29	253.18	264.31
9 $\frac{7}{8}$	193.90	203.71	213.77	224.07	234.61	245.40	256.43	267.70
10	196.35	206.29	216.48	226.91	237.58	248.50	259.67	271.07
10 $\frac{1}{8}$	198.81	208.87	219.18	229.74	240.55	251.61	262.92	274.47
10 $\frac{1}{4}$	201.26	211.45	221.89	232.58	243.52	254.72	266.16	277.86
10 $\frac{3}{8}$	203.72	214.03	224.59	235.42	246.49	257.82	269.41	281.25
10 $\frac{1}{2}$	206.17	216.61	227.30	238.25	249.46	260.93	272.66	284.64
10 $\frac{5}{8}$	208.62	219.18	230.01	241.09	252.43	264.04	275.90	288.03
10 $\frac{3}{4}$	211.08	221.76	232.71	243.93	255.40	267.14	279.15	291.42
10 $\frac{7}{8}$	213.53	224.34	235.42	246.76	258.37	270.25	282.39	294.81
11	215.99	226.92	238.12	249.60	261.34	273.36	285.64	298.19
11 $\frac{1}{8}$	218.44	229.50	240.83	252.43	264.31	276.46	288.89	301.58
11 $\frac{1}{4}$	220.90	232.08	243.54	255.27	267.28	279.57	292.13	304.97
11 $\frac{3}{8}$	223.35	234.65	246.24	258.11	270.25	282.67	295.38	308.36
11 $\frac{1}{2}$	225.81	237.23	248.95	260.94	273.22	285.78	298.62	311.75
11 $\frac{5}{8}$	228.26	239.81	251.65	263.78	276.19	288.89	301.87	315.14
11 $\frac{3}{4}$	230.72	242.39	254.36	266.62	279.16	291.99	305.12	318.53
11 $\frac{7}{8}$	233.17	244.97	257.76	269.45	282.13	295.10	308.36	321.91
12	235.62	247.55	259.77	272.29	285.10	298.21	311.61	325.30

Depth	DIAMETER							
	6	6 $\frac{1}{8}$	6 $\frac{1}{4}$	6 $\frac{3}{8}$	6 $\frac{1}{2}$	6 $\frac{5}{8}$	6 $\frac{3}{4}$	6 $\frac{7}{8}$
2 $\frac{1}{2}$	70.69	73.66	76.70	79.80	82.96	86.17	89.46	92.81
2 $\frac{5}{8}$	74.22	77.34	80.53	83.79	87.11	90.48	93.94	97.45
2 $\frac{3}{4}$	77.75	81.03	84.37	87.78	91.25	94.79	98.41	102.09
2 $\frac{7}{8}$	81.29	84.71	88.20	91.77	95.40	99.10	102.88	106.73
3	84.82	88.39	92.04	95.76	99.55	103.41	107.35	111.37
3 $\frac{1}{8}$	88.36	92.08	95.87	99.75	103.70	107.11	111.83	116.01
3 $\frac{1}{4}$	91.88	95.76	99.71	103.74	107.85	112.02	116.30	120.65
3 $\frac{3}{8}$	95.42	99.44	103.54	107.73	111.99	116.32	120.77	125.29
3 $\frac{1}{2}$	98.95	103.13	107.38	111.72	116.14	120.64	125.25	129.93
3 $\frac{5}{8}$	102.48	106.81	111.21	115.71	120.29	124.95	129.72	134.57
3 $\frac{3}{4}$	106.02	110.49	115.05	119.70	124.44	129.26	134.19	139.21
3 $\frac{7}{8}$	109.55	114.18	118.88	123.69	128.58	133.56	138.64	143.85
4	113.10	117.86	122.72	127.68	132.73	137.88	143.14	148.49
4 $\frac{1}{8}$	116.63	121.54	126.55	131.67	136.88	142.18	147.61	153.13
4 $\frac{1}{4}$	120.17	125.22	130.39	135.66	141.03	146.49	152.09	157.77
4 $\frac{3}{8}$	123.70	128.91	134.22	139.65	145.18	150.80	156.56	162.41
4 $\frac{1}{2}$	127.24	132.59	138.06	143.64	149.32	155.11	161.03	167.05
4 $\frac{5}{8}$	130.77	136.27	141.89	147.63	153.47	159.42	165.50	171.69
4 $\frac{3}{4}$	134.30	139.96	145.73	151.62	157.62	163.72	169.98	176.33
4 $\frac{7}{8}$	137.84	143.64	149.56	155.61	161.77	168.03	174.45	180.97
5	141.37	147.32	153.40	159.60	165.92	172.34	178.92	185.61
5 $\frac{1}{8}$	144.91	151.01	157.23	163.59	170.06	176.65	183.40	190.25
5 $\frac{1}{4}$	148.44	154.69	161.07	167.58	174.21	180.96	187.87	194.89
5 $\frac{3}{8}$	151.97	158.37	164.90	171.57	178.36	185.27	192.34	199.53
5 $\frac{1}{2}$	155.51	162.06	168.74	175.56	182.51	189.58	196.82	204.17
5 $\frac{5}{8}$	159.04	165.74	172.57	179.55	186.66	193.89	201.29	208.81
5 $\frac{3}{4}$	162.58	169.42	176.40	183.54	190.80	198.19	205.76	213.45
5 $\frac{7}{8}$	166.11	173.10	180.24	187.52	194.95	202.50	210.24	218.09
6	169.65	176.79	184.08	191.51	199.10	206.81	214.71	222.73
6 $\frac{1}{8}$	173.18	180.47	187.91	195.50	203.25	211.12	219.18	227.37
6 $\frac{1}{4}$	176.72	184.15	191.75	199.49	207.39	215.43	223.65	232.01
6 $\frac{3}{8}$	180.25	187.84	195.58	203.48	211.54	219.74	228.13	236.65
6 $\frac{1}{2}$	183.78	191.52	199.42	207.47	215.69	224.05	232.60	241.29
6 $\frac{5}{8}$	187.32	195.20	203.25	211.46	219.84	228.36	237.07	245.93
6 $\frac{3}{4}$	190.85	198.89	207.09	215.45	223.99	232.66	241.55	250.57
6 $\frac{7}{8}$	194.39	202.57	210.92	219.44	228.13	236.97	246.02	255.21
7	197.92	206.25	214.76	223.43	232.28	241.28	250.49	259.85
7 $\frac{1}{8}$	201.46	209.93	218.59	227.42	236.43	245.59	254.97	264.49
7 $\frac{1}{4}$	204.99	213.62	222.43	231.41	240.58	249.90	259.44	269.13

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Depth	DIAMETER							
	6	6 $\frac{1}{8}$	6 $\frac{1}{4}$	6 $\frac{3}{8}$	6 $\frac{1}{2}$	6 $\frac{5}{8}$	6 $\frac{3}{4}$	6 $\frac{7}{8}$
7 $\frac{3}{8}$	208.52	217.30	226.26	235.40	244.73	254.21	263.91	273.78
7 $\frac{1}{2}$	212.06	220.98	230.10	239.39	248.87	258.52	268.39	278.42
7 $\frac{5}{8}$	215.59	224.67	233.93	243.38	253.02	262.82	272.86	283.06
7 $\frac{3}{4}$	219.13	228.35	237.77	247.37	257.17	267.13	277.33	287.70
7 $\frac{7}{8}$	222.66	232.03	241.60	251.36	261.32	271.44	281.85	292.34
8	226.20	235.72	245.44	255.35	265.47	275.75	286.28	296.98
8 $\frac{1}{8}$	229.73	239.40	249.27	259.34	269.61	280.06	290.75	301.62
8 $\frac{1}{4}$	233.26	243.08	253.11	263.33	273.76	284.37	295.23	306.26
8 $\frac{3}{8}$	236.80	246.77	256.94	267.32	277.91	288.68	299.70	310.90
8 $\frac{1}{2}$	240.33	250.45	260.78	271.31	282.06	292.98	304.17	315.54
8 $\frac{5}{8}$	243.87	254.13	264.61	275.30	286.20	297.29	308.64	320.18
8 $\frac{3}{4}$	247.40	257.82	268.45	279.29	290.35	301.60	313.12	324.82
8 $\frac{7}{8}$	250.94	261.50	272.28	283.28	294.50	305.91	317.59	329.46
9	254.47	265.18	276.12	287.27	298.65	310.22	322.06	334.10
9 $\frac{1}{8}$	258.00	268.86	279.95	291.26	302.80	314.53	326.54	338.74
9 $\frac{1}{4}$	261.54	272.55	283.79	295.25	306.94	319.84	331.01	343.38
9 $\frac{3}{8}$	265.07	276.23	287.62	299.24	311.09	323.14	335.48	348.02
9 $\frac{1}{2}$	268.61	279.91	291.46	303.23	315.24	327.45	339.96	352.66
9 $\frac{5}{8}$	272.14	283.60	295.29	307.22	319.39	331.76	344.43	357.30
9 $\frac{3}{4}$	275.68	287.28	299.13	311.21	323.54	336.07	348.90	361.94
9 $\frac{7}{8}$	279.21	290.96	302.96	315.20	327.68	340.38	353.37	366.58
10	282.74	294.65	306.80	319.19	331.83	344.69	357.85	371.22
10 $\frac{1}{8}$	286.28	298.33	310.63	323.18	335.98	349.00	362.32	375.86
10 $\frac{1}{4}$	289.81	302.01	314.47	327.17	340.13	353.30	366.79	380.50
10 $\frac{3}{8}$	293.35	305.69	318.30	331.16	344.28	357.61	371.27	385.14
10 $\frac{1}{2}$	296.88	309.38	322.13	335.15	348.42	361.92	375.74	389.78
10 $\frac{5}{8}$	300.42	313.06	325.97	339.14	352.57	366.23	380.21	394.42
10 $\frac{3}{4}$	303.95	316.74	329.81	343.13	356.72	370.54	384.69	399.06
10 $\frac{7}{8}$	307.48	320.43	333.64	347.12	360.87	374.85	389.16	403.70
11	311.02	324.10	337.48	351.11	365.01	379.16	393.63	408.34
11 $\frac{1}{8}$	314.55	327.78	341.31	355.10	369.16	383.46	398.11	412.98
11 $\frac{1}{4}$	318.09	331.47	345.15	359.09	373.31	387.77	402.58	417.62
11 $\frac{3}{8}$	321.62	335.15	348.98	363.08	377.46	392.08	407.05	422.26
11 $\frac{1}{2}$	325.16	338.83	352.82	367.07	381.61	396.39	411.52	426.90
11 $\frac{5}{8}$	328.69	342.52	356.65	371.06	385.75	400.70	416.00	431.54
11 $\frac{3}{4}$	332.22	346.20	360.49	375.05	389.90	405.01	420.47	436.18
11 $\frac{7}{8}$	335.75	349.88	364.32	379.04	394.05	409.32	424.94	440.82
12	339.29	353.57	368.16	383.03	398.20	413.63	429.42	445.46

Depth	DIAMETER							
	7	7 $\frac{1}{8}$	7 $\frac{1}{4}$	7 $\frac{3}{8}$	7 $\frac{1}{2}$	7 $\frac{5}{8}$	7 $\frac{3}{4}$	7 $\frac{7}{8}$
2 $\frac{1}{2}$	96.21	99.68	103.21	106.80	110.45	114.16	117.93	121.77
2 $\frac{5}{8}$	101.02	104.66	108.37	112.14	115.97	119.87	123.83	127.86
2 $\frac{3}{4}$	105.83	109.65	113.53	117.48	121.49	125.57	129.73	133.94
2 $\frac{7}{8}$	110.64	114.63	118.69	122.82	127.01	131.28	135.62	140.03
3	115.45	119.61	123.85	128.16	132.54	136.99	141.52	146.12
3 $\frac{1}{8}$	120.26	124.60	129.01	133.50	138.06	142.70	147.42	152.21
3 $\frac{1}{4}$	125.08	129.58	134.17	138.83	143.58	148.41	153.31	158.30
3 $\frac{3}{8}$	129.89	134.57	139.33	144.17	149.10	154.11	159.21	164.39
3 $\frac{1}{2}$	134.70	139.55	144.49	149.51	154.62	159.82	165.11	170.47
3 $\frac{5}{8}$	139.51	144.53	149.65	154.85	160.15	165.53	171.00	176.56
3 $\frac{3}{4}$	144.32	149.52	154.81	160.19	165.67	171.25	176.90	182.65
3 $\frac{7}{8}$	149.13	154.50	159.97	165.53	171.19	176.95	182.80	188.74
4	153.94	159.49	165.13	170.87	176.72	182.65	188.69	194.83
4 $\frac{1}{8}$	158.75	164.47	170.29	176.21	182.24	188.36	194.59	200.92
4 $\frac{1}{4}$	163.56	169.45	175.45	181.55	187.76	194.07	200.49	207.01
4 $\frac{3}{8}$	168.37	174.44	180.61	186.89	193.28	199.78	206.38	213.09
4 $\frac{1}{2}$	173.18	179.42	185.77	192.23	198.80	205.49	212.28	219.18
4 $\frac{5}{8}$	177.99	184.40	190.93	197.57	204.33	211.19	218.18	225.27
4 $\frac{3}{4}$	182.80	189.39	196.09	202.91	209.85	216.90	224.07	231.36
4 $\frac{7}{8}$	187.61	194.37	201.25	208.25	215.37	222.61	229.97	237.45
5	192.42	199.36	206.41	213.59	220.89	228.32	235.87	243.54
5 $\frac{1}{8}$	197.23	204.34	211.57	218.93	226.42	234.03	241.76	249.62
5 $\frac{1}{4}$	202.04	209.32	216.73	224.27	231.94	239.73	247.66	255.71
5 $\frac{3}{8}$	206.85	214.31	221.89	229.61	237.46	245.44	253.56	261.80
5 $\frac{1}{2}$	211.67	219.29	227.05	234.95	242.98	251.15	259.45	267.89
5 $\frac{5}{8}$	216.48	224.28	232.21	240.29	248.51	256.86	265.35	273.98
5 $\frac{3}{4}$	221.29	229.26	237.37	245.63	254.03	262.57	271.25	280.07
5 $\frac{7}{8}$	226.10	234.24	242.54	250.97	259.55	268.27	277.14	286.15
6	230.91	239.23	247.70	256.31	265.07	273.98	283.04	292.24
6 $\frac{1}{8}$	235.72	244.21	252.86	261.65	270.59	279.69	288.94	298.33
6 $\frac{1}{4}$	240.53	249.20	258.02	266.99	276.12	285.40	294.83	304.42
6 $\frac{3}{8}$	245.34	254.18	263.18	272.33	281.64	291.11	300.73	310.51
6 $\frac{1}{2}$	250.15	259.16	268.34	277.67	287.16	296.81	306.63	316.60
6 $\frac{5}{8}$	254.96	264.15	273.50	283.01	292.68	302.52	312.52	322.68
6 $\frac{3}{4}$	259.77	269.13	278.66	288.35	298.21	308.23	318.42	328.77
6 $\frac{7}{8}$	264.58	274.12	283.82	293.69	303.73	313.94	324.31	334.86
7	269.39	279.10	288.98	299.03	309.25	319.65	330.21	340.95
7 $\frac{1}{8}$	274.20	284.08	294.14	304.37	314.77	325.35	336.11	347.04
7 $\frac{1}{4}$	279.01	289.07	299.30	309.71	320.30	331.06	342.01	353.13

Depth	DIAMETER							
	7	7 $\frac{1}{8}$	7 $\frac{1}{4}$	7 $\frac{3}{8}$	7 $\frac{1}{2}$	7 $\frac{5}{8}$	7 $\frac{3}{4}$	7 $\frac{7}{8}$
7 $\frac{3}{8}$	283.82	294.05	304.46	315.05	325.82	336.77	347.90	359.21
7 $\frac{1}{2}$	288.63	299.03	309.62	320.39	331.34	342.48	353.80	365.30
7 $\frac{5}{8}$	293.45	304.02	314.78	325.73	336.86	348.18	359.69	371.39
7 $\frac{3}{4}$	298.26	309.00	319.94	331.07	342.39	353.89	365.59	377.48
7 $\frac{7}{8}$	303.07	313.99	325.10	336.41	347.91	359.60	371.49	383.57
8	307.88	318.97	330.26	341.75	353.43	365.31	377.38	389.66
8 $\frac{1}{8}$	312.69	323.95	335.42	347.09	358.95	371.02	383.28	395.75
8 $\frac{1}{4}$	317.50	328.94	340.58	352.43	364.47	376.72	389.18	401.83
8 $\frac{3}{8}$	322.31	333.92	345.74	357.77	370.00	382.43	395.07	407.92
8 $\frac{1}{2}$	327.12	338.91	350.90	363.11	375.52	388.14	400.97	414.01
8 $\frac{3}{4}$	331.93	343.89	356.06	368.45	381.04	393.85	406.87	420.10
8 $\frac{7}{8}$	336.74	348.87	361.22	373.79	386.56	399.56	412.76	426.19
9	341.55	353.86	366.38	379.13	392.09	405.26	418.66	432.28
9 $\frac{1}{8}$	346.36	358.84	371.54	384.47	397.61	410.97	424.56	438.36
9 $\frac{1}{4}$	351.17	363.83	376.70	389.81	403.13	416.68	430.45	444.45
9 $\frac{3}{8}$	355.98	368.81	381.86	395.15	408.65	422.39	436.35	450.54
9 $\frac{1}{2}$	360.79	373.79	387.02	400.49	414.18	428.10	442.25	456.63
9 $\frac{3}{4}$	365.60	378.78	392.18	405.82	419.70	433.80	448.14	462.72
9 $\frac{7}{8}$	370.41	383.76	397.34	411.16	425.22	439.51	454.04	468.81
10	375.23	388.75	402.51	416.50	430.74	445.22	459.94	474.89
10 $\frac{1}{8}$	380.04	393.73	407.67	421.84	436.27	450.93	465.83	480.98
10 $\frac{1}{4}$	384.85	398.71	412.83	427.18	441.79	456.64	471.73	487.07
10 $\frac{3}{8}$	389.66	403.70	417.99	432.52	447.31	462.34	477.63	493.16
10 $\frac{1}{2}$	394.47	408.68	423.15	437.86	452.83	468.05	483.52	499.25
10 $\frac{3}{4}$	399.28	413.66	428.31	443.20	458.35	473.76	489.42	505.34
10 $\frac{7}{8}$	404.09	418.65	433.47	448.54	463.88	479.47	495.32	511.42
11	408.90	423.63	438.63	453.88	469.40	485.18	501.21	517.51
11 $\frac{1}{8}$	413.71	428.62	443.79	459.22	474.92	490.88	507.11	523.60
11 $\frac{1}{4}$	418.52	433.60	448.95	464.56	480.44	496.59	513.01	529.69
11 $\frac{3}{8}$	423.33	438.58	454.11	469.90	485.97	502.30	518.90	535.78
11 $\frac{1}{2}$	428.14	443.57	459.27	475.24	491.49	508.01	524.80	541.87
11 $\frac{3}{4}$	432.95	448.55	464.43	480.58	497.01	513.72	530.70	547.95
11 $\frac{7}{8}$	437.76	453.54	469.59	485.92	502.53	519.42	536.59	554.04
12	442.57	458.52	474.75	491.26	508.06	525.13	542.49	560.13
12 $\frac{1}{8}$	447.38	463.50	479.91	496.60	513.58	530.84	548.39	566.22
12 $\frac{1}{4}$	452.19	468.49	485.07	501.94	519.10	536.55	554.28	572.31
12 $\frac{3}{8}$	457.00	473.47	490.23	507.28	524.62	542.25	560.18	578.40
12 $\frac{1}{2}$	461.82	478.46	495.39	512.62	530.15	547.96	566.08	584.48

Depth	DIAMETER							
	8	8½	8¼	8⅝	8½	8⅝	8¾	8⅞
2½	125.66	129.62	133.64	137.72	141.86	146.07	150.33	154.66
2⅝	131.95	136.10	140.32	144.61	148.96	153.37	157.85	162.39
2¾	138.23	142.58	147.00	151.49	156.05	160.67	165.36	170.12
2⅞	144.51	149.06	153.69	158.38	163.14	167.98	172.88	177.85
3	150.80	155.55	160.37	165.27	170.24	175.28	180.40	185.59
3⅛	157.08	162.03	167.05	172.15	177.33	182.58	187.91	193.32
3¼	163.36	168.51	173.73	179.04	184.42	189.89	195.43	201.05
3⅝	169.65	174.99	180.41	185.92	191.51	197.19	202.95	208.79
3½	175.93	181.47	187.10	192.81	198.61	204.49	210.46	216.52
3⅞	182.21	187.95	193.78	199.70	205.70	211.80	217.99	224.25
3¾	188.50	194.43	200.46	206.58	212.79	219.10	225.50	231.98
3⅞	194.78	200.91	207.14	213.47	219.89	226.40	233.01	239.72
4	201.06	207.39	213.83	220.35	226.98	233.71	240.53	247.45
4⅛	207.35	213.88	220.51	227.24	234.07	241.01	248.05	255.18
4¼	213.63	220.36	227.19	234.13	241.17	248.31	255.56	262.92
4⅝	219.91	226.84	233.87	241.01	248.26	255.62	263.08	270.65
4½	226.20	233.32	240.55	247.90	255.35	262.92	276.59	278.38
4⅞	232.48	249.80	247.24	254.78	262.45	270.22	278.11	286.11
4¾	238.76	246.28	253.92	261.67	269.54	277.53	285.63	293.85
4⅞	245.04	252.76	260.60	268.56	276.63	284.83	293.14	301.58
5	251.33	259.24	267.28	275.44	283.73	292.13	300.66	309.31
5⅛	257.61	265.72	273.96	282.33	290.82	299.44	308.18	317.05
5¼	263.89	272.21	280.65	289.21	297.91	306.74	315.69	324.78
5⅝	270.18	278.69	287.33	296.10	305.01	314.04	323.21	332.51
5½	276.46	285.17	294.01	303.99	312.10	321.35	330.73	340.24
5⅞	282.74	291.65	300.69	309.87	319.19	328.65	338.24	347.98
5¾	289.03	298.13	307.37	316.76	326.28	335.95	345.76	355.71
5⅞	295.31	304.61	314.06	323.64	333.38	343.26	353.28	363.44
6	301.59	311.09	320.74	330.53	340.47	350.56	360.79	371.18
6⅛	307.88	317.57	327.42	337.42	347.56	357.86	368.31	378.91
6¼	314.16	324.05	334.10	344.30	354.66	365.17	375.83	386.64
6⅝	320.44	330.54	340.78	351.19	361.75	372.47	383.34	394.37
6½	326.73	337.02	347.47	358.07	368.84	379.77	390.86	402.11
6⅞	333.01	343.50	354.15	364.96	375.94	387.07	398.38	409.84
6¾	339.29	349.98	360.83	371.85	383.03	394.38	405.89	417.57
6⅞	345.58	356.46	367.51	378.73	390.12	401.68	413.41	425.30
7	351.86	362.94	374.19	385.62	397.22	408.98	420.93	433.04
7⅛	358.14	369.42	380.98	392.51	404.31	416.29	428.44	440.77
7¼	364.43	375.90	387.56	399.39	411.40	423.59	435.96	448.50

Depth	DIAMETER							
	8	8 $\frac{1}{8}$	8 $\frac{1}{4}$	8 $\frac{3}{8}$	8 $\frac{1}{2}$	8 $\frac{5}{8}$	8 $\frac{3}{4}$	8 $\frac{7}{8}$
7 $\frac{3}{8}$	370.71	382.38	394.24	406.28	418.50	430.89	443.47	456.24
7 $\frac{1}{2}$	376.99	388.87	400.92	413.16	425.59	438.20	450.99	463.97
7 $\frac{5}{8}$	383.28	395.35	407.60	420.05	432.68	445.50	458.51	471.70
7 $\frac{3}{4}$	389.56	401.83	414.29	426.94	439.77	452.80	466.02	479.43
7 $\frac{7}{8}$	395.84	408.31	420.97	433.82	446.87	460.11	473.54	487.17
8	402.12	414.79	427.65	440.71	453.96	467.41	481.06	494.90
8 $\frac{1}{8}$	408.41	421.27	434.33	447.59	461.05	474.71	488.57	502.63
8 $\frac{1}{4}$	414.69	427.75	441.01	454.48	468.15	482.02	496.09	510.37
8 $\frac{3}{8}$	420.97	434.23	447.70	461.37	475.24	489.32	503.61	518.10
8 $\frac{1}{2}$	427.26	440.71	454.38	468.25	482.33	496.62	511.12	525.83
8 $\frac{5}{8}$	433.54	447.19	461.06	475.14	489.43	503.93	518.64	533.56
8 $\frac{3}{4}$	439.82	453.68	467.74	482.02	496.52	511.23	526.16	541.30
8 $\frac{7}{8}$	446.11	460.16	474.42	488.91	503.61	518.53	533.67	549.03
9	452.39	466.64	481.11	495.80	510.71	525.84	541.19	556.76
9 $\frac{1}{8}$	458.67	473.12	487.79	502.68	517.80	533.14	548.71	564.50
9 $\frac{1}{4}$	464.96	479.60	494.47	509.57	524.89	540.44	556.22	572.23
9 $\frac{3}{8}$	471.24	486.08	501.15	516.45	531.99	547.75	563.74	579.96
9 $\frac{1}{2}$	477.52	492.56	507.83	523.34	539.08	555.05	571.26	587.69
9 $\frac{5}{8}$	483.81	499.04	514.52	530.23	546.17	562.35	578.77	595.43
9 $\frac{3}{4}$	490.09	505.52	521.20	537.11	553.27	569.66	586.29	603.16
9 $\frac{7}{8}$	496.37	512.01	527.88	544.00	560.36	576.96	593.81	610.89
10	502.66	518.49	534.56	550.88	567.45	584.26	601.32	618.63
10 $\frac{1}{8}$	508.94	524.97	541.24	557.77	574.54	591.57	608.84	626.36
10 $\frac{1}{4}$	515.22	531.45	547.93	564.66	581.64	598.87	616.35	634.09
10 $\frac{3}{8}$	521.51	537.93	554.61	571.54	588.73	606.17	623.87	641.82
10 $\frac{1}{2}$	527.79	544.41	561.29	578.43	595.82	613.48	631.39	649.56
10 $\frac{5}{8}$	534.07	550.89	567.97	585.31	602.92	620.78	638.90	657.29
10 $\frac{3}{4}$	540.36	557.37	574.65	592.20	610.01	628.08	646.42	665.02
10 $\frac{7}{8}$	546.64	563.85	581.34	599.09	617.10	635.39	653.94	672.75
11	552.92	570.34	588.02	605.97	624.20	642.69	661.45	680.49
11 $\frac{1}{8}$	559.20	576.82	594.70	612.86	631.29	649.99	668.97	688.22
11 $\frac{1}{4}$	565.49	583.30	601.38	619.75	638.38	657.30	676.49	695.95
11 $\frac{3}{8}$	571.77	589.78	608.07	626.63	645.48	664.60	684.00	703.69
11 $\frac{1}{2}$	578.05	596.26	614.75	633.52	652.57	671.90	691.52	711.42
11 $\frac{5}{8}$	584.34	602.74	621.43	640.40	659.66	679.21	699.04	719.15
11 $\frac{3}{4}$	590.62	609.22	628.11	647.29	666.76	686.51	707.55	726.88
11 $\frac{7}{8}$	596.90	615.70	634.79	654.18	673.85	693.81	714.07	734.62
12	603.19	622.18	641.48	661.06	680.94	701.12	721.59	742.35

Depth	DIAMETER							
	9	9½	9¼	9⅜	9½	9⅝	9¾	9⅞
2½	159.04	163.49	168.00	172.57	177.21	181.90	186.66	191.47
2⅝	167.00	171.67	176.40	181.20	186.07	190.99	195.99	201.05
2¾	174.95	179.84	184.80	189.83	194.93	200.09	205.32	210.62
2⅞	182.90	188.02	193.20	198.46	203.79	209.18	214.65	220.19
3	190.85	196.19	201.60	207.09	212.65	218.28	223.99	229.77
3⅛	198.80	204.37	210.00	215.72	221.51	227.37	233.32	239.34
3¼	206.76	212.54	218.40	224.35	230.37	236.47	242.65	248.91
3⅜	214.71	220.71	226.80	232.97	239.23	245.56	251.98	258.49
3½	222.66	228.89	235.20	241.60	248.09	254.66	261.32	268.06
3⅝	230.61	237.06	243.60	250.23	256.95	263.75	270.65	277.63
3¾	238.57	245.24	252.00	258.86	265.81	272.85	279.98	287.21
3⅞	246.52	253.41	260.40	267.49	274.67	281.94	289.32	296.78
4	254.47	261.59	268.80	276.12	283.53	291.04	298.65	306.36
4⅛	262.42	269.76	277.20	284.75	292.39	300.13	307.98	315.93
4¼	270.37	277.94	285.60	293.37	301.25	309.23	317.31	325.50
4⅜	278.33	286.11	294.00	302.00	310.11	318.32	326.65	335.08
4½	286.28	294.29	302.40	310.63	318.97	327.42	335.98	344.65
4⅝	294.23	302.46	310.80	319.26	327.83	336.51	345.31	354.22
4¾	302.18	310.63	319.20	327.89	336.69	345.61	354.64	363.80
4⅞	310.15	318.81	327.60	336.52	345.55	354.70	363.98	373.37
5	318.09	326.98	336.00	345.15	354.41	363.80	373.31	382.94
5⅛	326.04	335.16	344.40	353.78	363.27	372.89	382.64	392.52
5¼	333.99	343.33	352.80	362.40	372.13	381.99	391.98	402.09
5⅜	341.95	351.51	361.20	371.03	380.99	391.08	401.31	411.66
5½	349.90	359.68	369.60	379.66	389.85	400.18	410.64	421.24
5⅝	357.85	367.86	378.00	388.29	398.71	409.27	419.97	430.81
5¾	365.80	376.03	386.40	396.92	407.57	418.37	429.31	440.39
5⅞	373.75	384.21	394.80	405.55	416.43	427.46	438.64	449.96
6	381.71	392.38	403.20	414.18	425.29	436.56	447.97	459.53
6⅛	389.66	400.56	411.60	422.80	434.15	445.65	457.31	469.11
6¼	397.61	408.73	420.01	431.43	443.01	454.75	466.64	478.68
6⅜	405.56	416.90	428.41	440.06	451.87	463.84	475.97	488.25
6½	413.51	425.08	436.81	448.69	460.74	472.94	485.30	497.83
6⅝	421.47	433.25	445.21	457.32	469.60	482.03	494.64	507.40
6¾	429.41	441.43	453.61	465.95	478.46	491.13	503.97	516.97
6⅞	437.37	449.60	462.01	474.58	487.32	500.23	513.30	526.55
7	445.32	457.78	470.41	483.21	496.18	509.32	522.63	536.12
7⅛	453.27	465.95	478.81	491.83	505.04	518.41	531.97	545.70
7¼	461.23	474.13	487.21	500.46	513.90	527.51	541.30	555.27

Depth	DIAMETER							
	9	9 $\frac{1}{8}$	9 $\frac{1}{4}$	9 $\frac{3}{8}$	9 $\frac{1}{2}$	9 $\frac{5}{8}$	9 $\frac{3}{4}$	9 $\frac{7}{8}$
7 $\frac{3}{8}$	469.18	482.30	495.61	509.09	522.76	536.60	550.63	564.84
7 $\frac{1}{2}$	477.13	490.48	504.01	517.72	531.62	545.70	559.97	574.42
7 $\frac{7}{8}$	485.08	498.65	512.41	526.35	540.48	554.79	569.30	583.99
7 $\frac{3}{4}$	493.04	506.83	520.81	534.98	549.34	563.89	578.63	593.56
7 $\frac{7}{8}$	500.99	515.00	529.21	543.61	558.20	572.98	587.96	603.14
8	508.94	523.17	537.61	552.23	567.06	582.08	597.30	612.71
8 $\frac{1}{8}$	516.89	531.35	546.01	560.86	575.92	591.17	606.63	622.28
8 $\frac{1}{4}$	524.84	539.52	554.41	569.49	584.78	600.27	615.96	631.86
8 $\frac{3}{8}$	532.80	547.70	562.81	578.12	593.64	609.36	625.30	641.43
8 $\frac{1}{2}$	540.75	555.87	571.21	586.75	602.50	618.46	634.63	651.00
8 $\frac{3}{8}$	548.70	564.05	579.61	595.38	611.36	627.55	643.96	660.58
8 $\frac{3}{4}$	556.65	572.22	588.01	604.01	620.22	636.65	653.29	670.15
8 $\frac{7}{8}$	564.61	580.40	596.41	612.64	628.08	645.74	662.63	679.73
9	572.56	588.57	604.81	621.26	637.94	654.84	671.96	689.30
9 $\frac{1}{8}$	580.51	596.75	613.21	629.89	646.80	663.93	681.29	698.87
9 $\frac{1}{4}$	588.46	604.92	621.61	638.52	655.66	673.03	690.62	708.45
9 $\frac{3}{8}$	596.41	613.10	630.01	647.15	664.52	682.12	699.96	718.02
9 $\frac{1}{2}$	604.37	621.27	638.41	655.78	673.38	691.22	709.29	727.59
9 $\frac{5}{8}$	612.32	629.44	646.81	664.41	682.24	700.31	718.62	737.17
9 $\frac{3}{4}$	620.27	637.62	655.21	673.04	691.10	709.41	727.96	746.74
9 $\frac{7}{8}$	628.22	645.79	663.61	681.66	699.96	718.50	737.29	756.31
10	636.18	653.97	672.01	690.29	708.82	727.60	746.62	765.89
10 $\frac{1}{8}$	644.13	662.14	680.41	698.92	717.68	736.69	755.95	775.46
10 $\frac{1}{4}$	652.08	670.32	688.81	707.52	726.54	745.79	765.29	785.04
10 $\frac{3}{8}$	660.03	678.49	697.21	716.18	735.40	754.88	774.62	794.61
10 $\frac{1}{2}$	667.98	686.67	705.61	724.81	744.26	763.98	783.95	804.18
10 $\frac{5}{8}$	675.94	694.84	714.01	733.44	753.12	773.07	793.28	813.76
10 $\frac{3}{4}$	683.89	703.02	722.41	742.06	761.99	782.17	802.62	823.33
10 $\frac{7}{8}$	691.84	711.19	730.81	750.69	770.85	791.26	811.95	832.90
11	699.79	719.37	739.21	759.32	779.71	800.36	821.28	842.48
11 $\frac{1}{8}$	707.74	727.54	747.61	767.95	788.57	810.45	830.62	852.05
11 $\frac{1}{4}$	715.70	735.71	756.01	776.58	797.43	819.55	839.95	861.62
11 $\frac{3}{8}$	723.65	743.89	764.41	785.21	806.29	828.64	849.28	871.20
11 $\frac{1}{2}$	731.60	752.06	772.81	793.84	815.15	837.74	858.61	880.77
11 $\frac{5}{8}$	739.55	760.24	781.21	802.47	824.01	846.83	867.95	890.34
11 $\frac{3}{4}$	747.50	768.41	789.61	811.19	832.87	855.93	877.29	899.92
11 $\frac{7}{8}$	755.46	776.59	798.01	819.72	841.73	864.02	886.61	909.49
12	763.41	784.76	806.41	828.35	850.59	873.12	895.95	919.07

Depth	DIAMETER							
	10	10 $\frac{1}{8}$	10 $\frac{1}{4}$	10 $\frac{3}{8}$	10 $\frac{1}{2}$	10 $\frac{5}{8}$	10 $\frac{3}{4}$	10 $\frac{7}{8}$
2 $\frac{1}{2}$	196.35	201.29	206.29	211.35	216.48	221.66	226.91	232.21
2 $\frac{5}{8}$	206.17	211.35	216.60	221.92	227.30	232.74	238.25	243.83
2 $\frac{3}{4}$	215.99	221.42	226.92	232.49	238.12	243.83	249.60	255.44
2 $\frac{7}{8}$	225.80	231.48	237.23	243.06	248.95	254.91	260.94	267.05
3	235.62	241.55	247.55	253.62	259.77	265.99	272.29	278.66
3 $\frac{1}{8}$	245.44	251.61	257.86	264.19	270.59	277.08	283.63	290.27
3 $\frac{1}{4}$	255.26	261.68	268.18	274.76	281.42	288.16	294.98	301.88
3 $\frac{3}{8}$	265.07	271.74	278.49	285.33	292.24	299.24	306.32	313.49
3 $\frac{1}{2}$	274.89	281.81	288.81	295.89	303.07	310.33	317.67	325.10
3 $\frac{5}{8}$	284.71	291.87	299.12	306.46	313.89	321.41	329.02	336.71
3 $\frac{3}{4}$	294.53	301.93	309.44	317.03	324.71	332.49	340.36	348.32
3 $\frac{7}{8}$	304.34	312.00	319.75	327.60	335.54	343.57	351.71	359.93
4	314.16	322.06	330.06	338.16	346.36	354.66	363.05	371.54
4 $\frac{1}{8}$	323.98	332.13	340.38	348.73	357.19	365.74	374.40	383.15
4 $\frac{1}{4}$	333.80	342.19	350.69	359.30	368.01	376.82	385.74	394.76
4 $\frac{3}{8}$	343.61	352.26	361.01	369.87	378.83	387.91	397.09	406.38
4 $\frac{1}{2}$	353.43	362.32	371.32	380.43	389.66	399.99	408.43	417.99
4 $\frac{5}{8}$	363.25	372.39	381.64	391.00	400.48	410.07	419.78	429.60
4 $\frac{3}{4}$	373.07	382.45	391.95	401.57	411.30	421.16	431.12	441.21
4 $\frac{7}{8}$	382.88	392.51	402.27	412.14	422.13	432.24	442.47	452.82
5	392.70	402.58	412.58	422.70	432.95	443.32	453.81	464.43
5 $\frac{1}{8}$	402.52	412.64	422.90	433.27	443.78	454.40	465.16	476.04
5 $\frac{1}{4}$	412.34	422.71	433.21	443.84	454.60	465.49	476.50	487.65
5 $\frac{3}{8}$	422.15	432.77	443.52	454.41	465.42	476.57	487.85	499.26
5 $\frac{1}{2}$	431.97	442.84	453.84	464.98	476.25	487.65	499.20	510.87
5 $\frac{5}{8}$	441.79	452.90	464.15	475.54	487.07	498.74	510.54	522.48
5 $\frac{3}{4}$	451.61	462.97	474.47	486.11	497.89	509.82	521.89	534.09
5 $\frac{7}{8}$	461.42	473.03	484.78	496.68	508.72	520.90	533.23	545.70
6	471.24	483.09	495.10	507.25	519.54	531.99	544.58	557.31
6 $\frac{1}{8}$	481.06	493.16	505.41	517.81	530.37	543.07	555.92	568.93
6 $\frac{1}{4}$	490.88	503.22	515.73	528.38	541.19	554.15	567.27	580.54
6 $\frac{3}{8}$	500.69	513.29	526.04	538.95	552.01	565.23	578.61	592.15
6 $\frac{1}{2}$	510.51	523.35	536.35	549.52	562.84	576.32	589.96	603.76
6 $\frac{5}{8}$	520.33	533.42	546.67	560.08	573.66	587.40	601.30	615.37
6 $\frac{3}{4}$	530.15	543.48	556.98	570.65	584.48	598.48	612.65	626.98
6 $\frac{7}{8}$	539.96	553.55	567.30	581.22	595.31	609.57	623.99	638.59
7	549.78	563.61	577.61	591.79	606.13	620.65	635.34	650.20
7 $\frac{1}{8}$	559.60	573.67	587.93	602.35	616.96	631.73	646.68	661.81
7 $\frac{1}{4}$	569.42	583.74	598.24	612.92	627.78	642.82	658.03	673.42

Depth	DIAMETER							
	10	10 $\frac{1}{8}$	10 $\frac{1}{4}$	10 $\frac{3}{8}$	10 $\frac{1}{2}$	10 $\frac{5}{8}$	10 $\frac{3}{4}$	10 $\frac{7}{8}$
7 $\frac{3}{8}$	579.23	593.80	608.56	623.49	638.60	653.90	669.38	685.03
7 $\frac{1}{2}$	589.05	603.87	618.87	634.06	649.43	664.98	680.72	696.64
7 $\frac{5}{8}$	598.87	613.93	629.19	644.62	660.25	676.07	692.07	708.25
7 $\frac{3}{4}$	608.69	624.00	639.50	655.19	671.08	687.15	703.41	719.87
7 $\frac{7}{8}$	618.50	634.06	649.81	665.76	681.90	698.23	714.76	731.48
8	628.32	644.13	660.13	676.33	692.72	709.31	726.10	743.09
8 $\frac{1}{8}$	638.14	654.19	670.44	686.90	703.55	720.40	737.45	754.70
8 $\frac{1}{4}$	647.96	664.26	680.76	697.46	714.37	731.48	748.79	766.31
8 $\frac{3}{8}$	657.77	674.32	691.07	708.03	725.19	742.56	760.14	777.92
8 $\frac{1}{2}$	667.59	684.38	701.39	718.60	736.02	753.65	771.48	789.53
8 $\frac{5}{8}$	677.41	694.45	711.70	729.17	746.84	764.73	782.82	801.14
8 $\frac{3}{4}$	687.23	704.51	722.02	739.73	757.67	775.81	794.17	812.75
8 $\frac{7}{8}$	697.04	714.58	732.33	750.30	768.49	786.90	805.52	824.36
9	706.86	724.63	742.64	760.87	779.31	797.98	816.87	835.97
9 $\frac{1}{8}$	716.68	734.71	752.96	771.44	790.14	809.06	828.21	847.58
9 $\frac{1}{4}$	726.50	744.77	763.27	782.00	800.96	820.14	839.56	859.19
9 $\frac{3}{8}$	736.31	754.84	773.59	792.57	811.78	831.23	850.90	870.80
9 $\frac{1}{2}$	746.13	764.90	783.90	803.14	822.61	842.31	862.25	882.42
9 $\frac{5}{8}$	755.95	774.96	794.22	813.71	833.43	853.39	873.59	894.03
9 $\frac{3}{4}$	765.77	785.03	804.53	824.27	844.26	864.48	884.94	905.64
9 $\frac{7}{8}$	775.58	795.09	814.85	834.84	855.08	875.56	896.28	917.25
10	785.40	805.16	825.16	845.41	865.90	886.64	907.63	928.86
10 $\frac{1}{8}$	795.22	815.22	835.48	855.98	876.73	897.73	918.97	940.47
10 $\frac{1}{4}$	805.04	825.29	845.79	866.54	887.55	908.81	930.32	952.08
10 $\frac{3}{8}$	814.85	835.35	856.10	877.11	898.37	919.89	941.66	963.69
10 $\frac{1}{2}$	824.67	845.42	866.42	887.68	909.20	930.98	953.01	975.30
10 $\frac{5}{8}$	834.49	855.48	876.73	898.25	920.02	942.06	964.35	986.91
10 $\frac{3}{4}$	844.31	865.54	887.05	908.82	930.85	953.14	975.70	998.52
10 $\frac{7}{8}$	854.12	875.61	897.36	919.38	941.67	964.22	987.05	1010.13
11	863.94	885.67	907.68	929.95	952.49	975.31	998.39	1021.74
11 $\frac{1}{8}$	873.76	895.74	917.99	940.52	963.32	986.39	1009.74	1033.35
11 $\frac{1}{4}$	883.58	905.80	928.31	951.09	974.14	997.47	1021.08	1044.97
11 $\frac{3}{8}$	893.40	915.87	938.62	961.65	984.97	1008.56	1032.43	1056.58
11 $\frac{1}{2}$	903.21	925.93	948.94	972.22	995.79	1019.64	1043.77	1068.19
11 $\frac{5}{8}$	913.03	936.00	959.25	982.79	1006.61	1030.72	1055.12	1079.80
11 $\frac{3}{4}$	922.85	946.06	969.56	993.36	1017.44	1041.81	1066.46	1091.41
11 $\frac{7}{8}$	932.66	956.12	979.88	1003.92	1028.26	1052.89	1077.81	1103.02
12	942.48	966.19	990.19	1014.49	1039.08	1063.97	1089.15	1114.62

Depth	DIAMETER							
	11	11 $\frac{1}{8}$	11 $\frac{1}{4}$	11 $\frac{3}{8}$	11 $\frac{1}{2}$	11 $\frac{5}{8}$	11 $\frac{3}{4}$	11 $\frac{7}{8}$
2 $\frac{1}{2}$	237.58	243.01	248.51	254.06	259.67	265.35	271.09	276.88
2 $\frac{5}{8}$	249.46	255.16	260.93	266.76	272.66	278.62	284.64	290.73
2 $\frac{3}{4}$	261.34	267.32	273.36	279.46	285.64	291.88	298.20	304.57
2 $\frac{7}{8}$	273.22	279.47	285.78	292.17	298.62	305.15	311.75	318.42
3	285.10	291.62	298.21	304.87	311.61	318.42	325.30	332.26
3 $\frac{1}{8}$	296.98	303.77	310.63	317.57	324.59	331.69	338.86	346.11
3 $\frac{1}{4}$	308.86	315.92	323.06	330.28	337.57	344.95	352.41	359.95
3 $\frac{3}{8}$	320.74	328.07	335.48	342.98	350.56	358.22	365.97	373.79
3 $\frac{1}{2}$	332.62	340.22	347.91	355.68	363.54	371.49	379.52	387.64
3 $\frac{5}{8}$	344.50	352.37	360.33	368.38	376.53	384.76	393.08	401.48
3 $\frac{3}{4}$	356.38	364.52	372.76	381.09	389.51	398.02	406.63	415.33
3 $\frac{7}{8}$	368.25	376.67	385.18	393.79	402.49	411.29	420.18	429.17
4	380.13	388.82	397.61	406.49	415.48	424.56	433.74	443.01
4 $\frac{1}{8}$	392.01	400.97	410.03	419.20	428.46	437.83	447.29	456.86
4 $\frac{1}{4}$	403.89	413.12	422.46	431.90	441.44	451.09	460.85	470.70
4 $\frac{3}{8}$	415.77	425.27	434.88	444.60	454.43	464.36	474.40	484.55
4 $\frac{1}{2}$	427.65	437.42	447.31	457.31	467.41	477.63	487.96	498.39
4 $\frac{5}{8}$	439.53	449.58	459.74	470.01	480.39	490.89	501.51	512.24
4 $\frac{3}{4}$	451.41	461.73	472.16	482.71	493.38	504.16	515.07	526.08
4 $\frac{7}{8}$	463.29	473.88	484.59	495.41	506.36	517.44	528.62	539.92
5	475.17	486.03	497.01	508.12	519.35	530.70	542.17	553.77
5 $\frac{1}{8}$	487.05	498.18	509.44	520.82	532.33	543.96	555.73	567.61
5 $\frac{1}{4}$	498.93	510.33	521.86	533.52	545.31	557.23	569.28	581.46
5 $\frac{3}{8}$	510.80	522.48	534.29	546.23	558.30	570.50	582.84	595.30
5 $\frac{1}{2}$	522.68	534.63	546.71	558.93	571.28	583.77	596.39	609.15
5 $\frac{5}{8}$	534.56	546.78	569.14	571.63	584.26	597.03	609.95	622.99
5 $\frac{3}{4}$	546.44	558.93	571.56	584.33	597.25	610.30	623.50	636.83
5 $\frac{7}{8}$	558.32	571.08	583.99	597.04	610.23	623.57	637.05	650.68
6	570.20	583.23	596.41	609.74	623.21	636.84	650.61	664.52
6 $\frac{1}{8}$	582.08	595.38	608.84	622.44	636.20	650.10	664.16	678.37
6 $\frac{1}{4}$	593.96	607.53	621.26	635.15	649.18	663.37	677.72	692.21
6 $\frac{3}{8}$	605.84	619.69	633.69	647.85	662.17	676.64	691.27	706.05
6 $\frac{1}{2}$	617.72	631.84	646.11	660.55	675.15	689.91	704.83	719.90
6 $\frac{5}{8}$	629.60	643.99	658.54	673.25	688.13	703.17	718.38	733.74
6 $\frac{3}{4}$	641.48	656.14	670.97	686.96	701.12	716.44	731.93	747.59
6 $\frac{7}{8}$	653.35	668.29	683.39	698.66	714.10	729.71	745.49	761.43
7	655.23	680.44	695.82	711.36	727.08	742.98	759.04	775.28
7 $\frac{1}{8}$	677.11	692.59	708.24	724.07	740.07	756.24	772.60	789.12
7 $\frac{1}{4}$	688.99	704.74	720.67	736.77	753.05	769.51	786.15	802.96

DIAMETER

Depth	11	11 $\frac{1}{8}$	11 $\frac{1}{4}$	11 $\frac{3}{8}$	11 $\frac{1}{2}$	11 $\frac{5}{8}$	11 $\frac{3}{4}$	11 $\frac{7}{8}$
7 $\frac{3}{8}$	700.87	716.89	733.09	749.47	766.03	782.78	809.71	816.81
7 $\frac{1}{2}$	712.75	729.04	745.52	762.18	779.02	796.05	814.26	830.65
7 $\frac{5}{8}$	724.63	741.19	757.94	774.88	792.00	809.31	826.82	844.50
7 $\frac{3}{4}$	736.51	753.34	770.37	787.58	804.99	822.58	840.37	858.34
7 $\frac{7}{8}$	748.49	765.49	782.79	800.28	817.98	835.85	853.92	872.19
8	760.27	777.64	795.22	812.99	830.95	849.12	867.48	886.03
8 $\frac{1}{8}$	772.15	789.79	807.64	825.69	843.94	862.38	881.03	899.87
8 $\frac{1}{4}$	784.03	801.95	820.07	838.39	856.92	875.65	894.59	913.72
8 $\frac{3}{8}$	795.90	814.10	832.49	851.10	869.90	888.92	908.14	927.56
8 $\frac{1}{2}$	807.88	826.25	844.92	863.80	882.89	902.19	921.70	941.41
8 $\frac{5}{8}$	819.66	838.40	857.34	876.50	895.87	915.45	935.25	955.25
8 $\frac{3}{4}$	831.54	850.55	869.77	889.20	908.85	928.72	948.80	969.09
8 $\frac{7}{8}$	843.42	862.70	882.19	901.91	921.84	941.99	962.36	982.94
9	855.30	874.85	894.62	914.61	934.82	955.25	975.91	996.78
9 $\frac{1}{8}$	867.18	887.00	907.05	927.31	947.81	968.52	989.47	1010.63
9 $\frac{1}{4}$	879.06	899.15	919.47	940.02	960.79	981.79	1003.02	1024.47
9 $\frac{3}{8}$	890.94	911.30	931.90	952.72	973.77	995.06	1016.58	1038.32
9 $\frac{1}{2}$	902.82	923.45	944.32	965.42	986.76	1008.32	1030.13	1052.16
9 $\frac{5}{8}$	914.70	935.60	956.75	978.13	999.74	1021.59	1043.68	1066.00
9 $\frac{3}{4}$	926.58	947.75	969.17	990.83	1012.72	1034.86	1057.24	1079.85
9 $\frac{7}{8}$	938.46	959.90	981.60	1003.53	1025.71	1048.13	1070.79	1093.69
10	950.33	972.06	994.02	1016.23	1038.69	1061.39	1084.35	1107.54
10 $\frac{1}{8}$	962.21	984.21	1006.45	1028.94	1051.67	1074.66	1097.90	1121.38
10 $\frac{1}{4}$	974.09	996.36	1018.87	1041.64	1064.66	1087.93	1111.46	1135.23
10 $\frac{3}{8}$	986.97	1008.51	1031.30	1054.34	1077.64	1101.20	1125.01	1149.07
10 $\frac{1}{2}$	997.85	1020.66	1043.72	1067.05	1090.63	1114.46	1138.57	1162.91
10 $\frac{5}{8}$	1009.73	1032.81	1056.15	1079.75	1103.61	1127.73	1152.12	1176.76
10 $\frac{3}{4}$	1021.61	1044.96	1068.57	1092.45	1116.59	1141.00	1165.67	1190.60
10 $\frac{7}{8}$	1033.49	1057.11	1081.00	1105.15	1129.58	1154.27	1179.23	1204.45
11	1045.37	1069.26	1093.42	1117.86	1142.56	1167.53	1192.78	1218.29
11 $\frac{1}{8}$	1057.25	1081.41	1105.85	1130.56	1155.54	1180.80	1206.34	1232.13
11 $\frac{1}{4}$	1069.13	1093.56	1118.27	1143.26	1168.53	1194.07	1219.89	1245.98
11 $\frac{3}{8}$	1081.01	1105.71	1130.70	1155.97	1181.51	1207.34	1233.45	1259.82
11 $\frac{1}{2}$	1092.88	1117.86	1143.13	1168.67	1194.49	1220.60	1247.00	1273.67
11 $\frac{5}{8}$	1104.76	1130.01	1155.55	1181.37	1207.48	1233.87	1260.55	1287.51
11 $\frac{3}{4}$	1116.64	1142.16	1167.98	1194.07	1220.46	1247.14	1274.11	1301.36
11 $\frac{7}{8}$	1128.52	1154.32	1180.40	1206.78	1233.45	1260.41	1287.66	1314.20
12	1140.40	1166.47	1192.83	1219.48	1246.43	1273.67	1301.22	1329.04

Depth	DIAMETER							
	12	12 $\frac{1}{8}$	12 $\frac{1}{4}$	12 $\frac{3}{8}$	12 $\frac{1}{2}$	12 $\frac{5}{8}$	12 $\frac{3}{4}$	12 $\frac{7}{8}$
2 $\frac{1}{2}$	282.74	288.66	294.65	300.69	306.80	312.96	319.19	325.48
2 $\frac{5}{8}$	296.88	303.10	309.38	315.73	322.14	328.61	335.15	341.75
2 $\frac{3}{4}$	311.02	317.53	324.11	330.76	337.48	344.26	351.11	358.03
2 $\frac{7}{8}$	325.15	331.96	338.84	345.80	352.82	359.91	367.07	364.30
3	339.29	346.40	353.58	360.83	368.16	375.56	383.03	380.58
3 $\frac{1}{8}$	353.43	360.83	368.31	375.86	383.50	391.20	398.99	406.85
3 $\frac{1}{4}$	367.57	375.26	383.04	390.90	398.84	406.85	414.95	423.13
3 $\frac{3}{8}$	381.70	389.70	397.77	405.93	414.18	422.50	430.91	439.40
3 $\frac{1}{2}$	395.84	404.13	412.51	420.97	429.52	438.15	446.87	455.67
3 $\frac{5}{8}$	409.98	418.56	427.24	436.00	444.86	453.80	462.83	471.95
3 $\frac{3}{4}$	424.11	433.00	441.97	451.04	460.20	469.45	478.79	488.22
3 $\frac{7}{8}$	438.25	447.43	456.70	466.07	475.54	485.09	494.75	504.50
4	452.39	461.86	471.44	481.11	490.88	500.74	510.71	520.77
4 $\frac{1}{8}$	466.53	476.30	486.17	496.14	506.21	516.39	526.67	537.04
4 $\frac{1}{4}$	480.66	490.73	500.90	511.18	521.55	532.04	542.63	553.32
4 $\frac{3}{8}$	494.80	505.16	515.63	526.21	536.89	547.69	558.59	569.59
4 $\frac{1}{2}$	508.94	519.60	530.37	541.24	552.23	563.33	574.54	585.87
4 $\frac{5}{8}$	523.08	534.03	545.10	556.28	567.57	578.98	590.50	602.14
4 $\frac{3}{4}$	537.21	548.46	559.83	571.31	582.91	594.63	606.46	618.41
4 $\frac{7}{8}$	551.35	562.90	574.56	586.35	598.25	610.28	622.42	634.69
5	565.49	577.33	589.30	601.38	613.59	625.93	638.38	650.96
5 $\frac{1}{8}$	579.62	591.76	604.03	616.42	628.93	641.58	654.34	667.24
5 $\frac{1}{4}$	593.76	606.20	618.76	631.45	644.27	657.22	670.30	683.51
5 $\frac{3}{8}$	607.90	620.63	633.49	646.49	659.61	672.87	686.26	699.78
5 $\frac{1}{2}$	622.04	635.06	648.23	661.52	674.95	688.52	702.22	716.06
5 $\frac{5}{8}$	636.17	649.50	662.96	676.56	690.29	704.17	718.18	732.33
5 $\frac{3}{4}$	650.31	663.93	677.69	691.59	705.63	719.82	734.14	748.61
5 $\frac{7}{8}$	664.45	678.36	692.42	706.63	720.97	735.46	750.10	764.88
6	678.58	692.79	707.15	721.66	736.31	751.11	766.06	781.15
6 $\frac{1}{8}$	692.72	707.23	721.89	736.69	751.65	766.76	782.02	797.43
6 $\frac{1}{4}$	706.86	721.66	736.62	751.73	766.99	782.41	797.98	813.70
6 $\frac{3}{8}$	721.00	736.09	751.35	766.76	782.33	798.06	813.94	829.98
6 $\frac{1}{2}$	735.13	750.53	766.08	781.80	797.67	813.76	829.90	846.25
6 $\frac{5}{8}$	749.27	764.96	780.82	796.83	813.01	829.35	845.86	862.52
6 $\frac{3}{4}$	763.41	779.39	795.55	811.87	828.35	845.00	861.82	878.80
6 $\frac{7}{8}$	777.54	793.83	810.28	826.90	843.69	860.65	877.78	895.07
7	791.68	808.26	825.01	841.94	859.03	876.30	893.74	911.35
7 $\frac{1}{8}$	805.82	822.69	839.75	856.97	874.37	891.95	909.70	927.62
7 $\frac{1}{4}$	819.96	837.13	854.48	872.01	889.71	907.59	925.66	943.89

Depth	DIAMETER							
	12	12 $\frac{1}{8}$	12 $\frac{1}{4}$	12 $\frac{3}{8}$	12 $\frac{1}{2}$	12 $\frac{5}{8}$	12 $\frac{3}{4}$	12 $\frac{7}{8}$
7 $\frac{3}{8}$	834.09	851.56	869.21	887.04	905.05	923.24	941.61	960.17
7 $\frac{1}{2}$	848.23	865.99	883.94	902.08	920.39	938.89	957.57	976.44
7 $\frac{5}{8}$	862.37	880.43	898.68	917.11	935.73	954.54	973.53	992.72
7 $\frac{3}{4}$	876.50	894.86	913.41	932.14	951.07	970.19	989.49	1008.99
7 $\frac{7}{8}$	890.64	909.29	928.14	947.18	966.41	985.84	1005.45	1025.26
8	904.78	923.73	942.87	962.21	981.75	1001.48	1021.41	1041.54
8 $\frac{1}{8}$	918.92	938.16	957.61	977.25	997.09	1017.13	1037.37	1057.81
8 $\frac{1}{4}$	933.05	952.59	972.34	992.28	1012.43	1032.78	1053.33	1074.09
8 $\frac{3}{8}$	947.19	967.03	987.07	1007.32	1027.77	1048.43	1069.29	1090.36
8 $\frac{1}{2}$	961.33	981.46	1001.80	1022.35	1043.11	1064.08	1085.25	1106.63
8 $\frac{5}{8}$	975.46	995.89	1016.53	1037.38	1058.45	1079.72	1101.21	1122.91
8 $\frac{3}{4}$	989.60	1010.33	1031.27	1052.42	1073.79	1095.37	1117.17	1139.18
8 $\frac{7}{8}$	1003.74	1024.76	1046.00	1067.46	1089.13	1111.02	1133.13	1155.46
9	1017.88	1039.19	1060.73	1082.49	1104.47	1126.67	1149.09	1171.73
9 $\frac{1}{8}$	1032.01	1053.63	1075.46	1097.52	1119.81	1142.32	1165.05	1188.00
9 $\frac{1}{4}$	1046.15	1068.06	1090.20	1112.56	1135.15	1157.97	1181.01	1204.28
9 $\frac{3}{8}$	1060.29	1082.49	1104.93	1127.59	1150.49	1173.61	1196.97	1220.55
9 $\frac{1}{2}$	1074.42	1096.93	1119.66	1142.63	1165.83	1189.26	1212.93	1236.82
9 $\frac{5}{8}$	1088.56	1111.36	1134.39	1157.66	1181.17	1204.91	1228.89	1253.10
9 $\frac{3}{4}$	1102.70	1125.79	1149.13	1172.70	1196.51	1220.56	1244.85	1269.37
9 $\frac{7}{8}$	1116.84	1140.22	1163.86	1187.73	1211.85	1236.21	1260.81	1285.65
10	1130.97	1154.65	1178.59	1202.77	1227.19	1251.85	1276.77	1301.92
10 $\frac{1}{8}$	1145.11	1169.09	1193.32	1217.80	1242.53	1267.50	1292.73	1318.20
10 $\frac{1}{4}$	1159.25	1183.52	1208.06	1232.84	1257.87	1283.15	1308.69	1334.47
10 $\frac{3}{8}$	1173.38	1197.96	1222.79	1247.87	1273.21	1298.80	1324.64	1350.75
10 $\frac{1}{2}$	1187.52	1212.39	1237.52	1262.90	1288.55	1314.45	1340.60	1367.02
10 $\frac{5}{8}$	1201.66	1226.82	1252.25	1277.94	1303.89	1330.09	1356.56	1383.29
10 $\frac{3}{4}$	1215.80	1241.26	1266.99	1292.97	1319.23	1345.74	1372.52	1399.57
10 $\frac{7}{8}$	1229.93	1255.69	1281.72	1308.01	1334.57	1361.39	1388.48	1415.84
11	1244.07	1270.12	1296.45	1323.04	1349.91	1377.04	1404.44	1432.12
11 $\frac{1}{8}$	1258.21	1284.56	1311.18	1338.08	1365.25	1392.69	1420.40	1448.39
11 $\frac{1}{4}$	1272.34	1298.99	1325.91	1353.11	1380.59	1408.33	1436.36	1464.66
11 $\frac{3}{8}$	1286.48	1313.42	1340.65	1368.15	1395.93	1423.98	1452.32	1480.94
11 $\frac{1}{2}$	1300.62	1327.86	1355.38	1383.18	1411.27	1439.63	1468.28	1497.21
11 $\frac{5}{8}$	1314.76	1342.29	1370.11	1398.22	1426.61	1455.28	1484.24	1513.49
11 $\frac{3}{4}$	1328.89	1356.72	1384.84	1413.25	1441.95	1470.93	1500.20	1529.76
11 $\frac{7}{8}$	1343.03	1371.16	1399.58	1428.29	1457.29	1486.58	1516.16	1546.03
12	1357.17	1385.59	1414.31	1443.32	1472.63	1502.22	1532.12	1562.31

U. S. DRY CAPACITY MEASURES

Tables giving the depths for variations in the diameters. These are used in connection with the dry measure gauge or an ordinary rule. To illustrate the use of the table, consider the following example: suppose the sealer is examining a measure that is supposed to be one peck and finds that the diameter is $9\frac{1}{4}$ inches, then to have the correct capacity its depth should be 8 inches, as given in the table.

$\frac{1}{2}$ Bushel		$\frac{1}{2}$ Peck		$\frac{1}{4}$ Peck	
Diam.	Height	Diam.	Height	Diam.	Height
$13\frac{1}{4}$	$7\frac{3}{4}$	$6\frac{1}{4}$	$8\frac{3}{4}$	$4\frac{3}{4}$	$7\frac{5}{8}$
$13\frac{1}{2}$	$7\frac{1}{2}$	$6\frac{1}{2}$	$8\frac{1}{8}$	5	$6\frac{7}{8}$
$13\frac{3}{4}$	$7\frac{1}{4}$	$6\frac{3}{4}$	$7\frac{1}{2}$	$5\frac{1}{4}$	$6\frac{1}{4}$
14	7	7	7	$5\frac{1}{2}$	$5\frac{5}{8}$
$14\frac{1}{4}$	$6\frac{3}{4}$	$7\frac{1}{4}$	$6\frac{1}{2}$	$5\frac{3}{4}$	$5\frac{1}{8}$
$14\frac{1}{2}$	$6\frac{1}{2}$	$7\frac{1}{2}$	$6\frac{1}{8}$	6	$4\frac{3}{4}$
$14\frac{3}{4}$	$6\frac{1}{4}$	$7\frac{3}{4}$	$5\frac{11}{16}$	$6\frac{1}{4}$	$4\frac{3}{8}$
1 Peck		1 Quart		1 Pint	
8	$10\frac{3}{4}$	$2\frac{3}{4}$	$11\frac{3}{8}$	2	$10\frac{5}{8}$
$8\frac{1}{4}$	10	3	$9\frac{1}{2}$	$2\frac{1}{4}$	$8\frac{1}{2}$
$8\frac{1}{2}$	$9\frac{1}{2}$	$3\frac{1}{4}$	$8\frac{1}{8}$	$2\frac{1}{2}$	$6\frac{7}{8}$
$8\frac{3}{4}$	9	$3\frac{1}{2}$	7	$2\frac{3}{4}$	$5\frac{5}{8}$
9	$8\frac{1}{2}$	$3\frac{3}{4}$	$6\frac{1}{8}$	$2\frac{3}{4}$	$5\frac{5}{8}$
$9\frac{1}{4}$	8	4	$5\frac{3}{8}$	3	$4\frac{3}{4}$
$9\frac{1}{2}$	$7\frac{5}{8}$	$4\frac{1}{4}$	$4\frac{3}{4}$	$3\frac{1}{4}$	4
$9\frac{3}{4}$	$7\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{1}{2}$
10	$6\frac{7}{8}$	$4\frac{3}{4}$	$3\frac{3}{4}$	$3\frac{3}{4}$	3
$10\frac{1}{4}$	$6\frac{1}{2}$	5	$3\frac{3}{8}$	4	$2\frac{5}{8}$
$10\frac{1}{2}$	$6\frac{1}{4}$	$5\frac{1}{4}$	$3\frac{1}{8}$	$4\frac{1}{4}$	$2\frac{3}{8}$
$10\frac{3}{4}$	$5\frac{7}{8}$				
11	$5\frac{5}{8}$				
$11\frac{1}{4}$	$5\frac{3}{8}$				
$11\frac{1}{2}$	$5\frac{1}{8}$				
$11\frac{3}{4}$	5				

The different cylindrical measures should contain very nearly the following number of cubic inches, and should conform with the different diameters and depths of this table, taking the Winchester Bushel for the U. S. Standard, which contains 2150.42 cubic inches. Diameter $18\frac{1}{2}$ inches, depth 8 inches.

WINCHESTER BUSHEL, U. S. STANDARD, 2150.42 CUBIC INCHES

1 qt., 67.20 cubic inches ; 2 qts., 134.40 cubic inches ; 4 qts., 268.80 cubic inches ; 8 qts., 537.60 cubic inches ; 16 qts., 1075.21 cubic inches.

1 quart		2 quarts		4 quarts		8 quarts		16 quarts	
Diam. in.	Depth in.	Diam. in.	Depth in.	Diam. in.	Depth in.	Diam. in.	Depth in.	Diam. in.	Depth in.
5	$3\frac{7}{16}$	6	$4\frac{3}{4}$	8	$5\frac{3}{8}$	10	$6\frac{7}{8}$	$12\frac{1}{2}$	$8\frac{3}{4}$
$5\frac{1}{8}$	$3\frac{1}{4}$	$6\frac{1}{8}$	$4\frac{9}{16}$	$8\frac{1}{8}$	$5\frac{3}{16}$	$10\frac{1}{8}$	$6\frac{1}{16}$	$12\frac{5}{8}$	$8\frac{9}{16}$
$5\frac{1}{4}$	$3\frac{1}{8}$	$6\frac{1}{4}$	$4\frac{3}{8}$	$8\frac{1}{4}$	5	$10\frac{1}{4}$	$6\frac{1}{2}$	$12\frac{3}{4}$	$8\frac{7}{16}$
$5\frac{3}{8}$	$2\frac{5}{16}$	$6\frac{3}{8}$	$4\frac{1}{16}$	$8\frac{3}{8}$	$4\frac{7}{8}$	$10\frac{3}{8}$	$6\frac{3}{8}$	$12\frac{7}{8}$	$8\frac{1}{4}$
$5\frac{1}{2}$	$2\frac{3}{16}$	$6\frac{1}{2}$	$4\frac{1}{16}$	$8\frac{1}{2}$	$4\frac{3}{4}$	$10\frac{1}{2}$	$6\frac{3}{16}$	13	$8\frac{1}{8}$
$5\frac{5}{8}$	$2\frac{1}{16}$	$6\frac{5}{8}$	$3\frac{7}{8}$	$8\frac{5}{8}$	$4\frac{5}{8}$	$10\frac{5}{8}$	$6\frac{1}{16}$	$13\frac{1}{8}$	$7\frac{15}{16}$
$5\frac{3}{4}$	$2\frac{9}{16}$	$6\frac{3}{4}$	$3\frac{3}{4}$	$8\frac{3}{4}$	$4\frac{1}{2}$	$10\frac{3}{4}$	$5\frac{5}{16}$	$13\frac{1}{4}$	$7\frac{13}{16}$
$5\frac{7}{8}$	$2\frac{1}{2}$	$6\frac{7}{8}$	$3\frac{5}{8}$	$8\frac{7}{8}$	$4\frac{5}{16}$	$10\frac{7}{8}$	$5\frac{3}{4}$	$13\frac{3}{8}$	$7\frac{5}{8}$
6	$2\frac{3}{8}$	7	$3\frac{1}{2}$	9	$4\frac{1}{8}$	11	$5\frac{5}{8}$	$13\frac{1}{2}$	$7\frac{1}{2}$
				$9\frac{1}{8}$	4	$11\frac{1}{8}$	$5\frac{1}{2}$	$13\frac{5}{8}$	$7\frac{3}{8}$
								$13\frac{3}{4}$	$7\frac{1}{4}$
								$13\frac{7}{8}$	$7\frac{1}{8}$
								14	7

Number of cubic inches in U. S. Standard Liquid capacity measures.

Liquid Measure			Dry Measure		
1	gallon contains	231 cu. in.	1	bushel contains	2150.42 cu. in.
$\frac{1}{2}$	"	115.5 "	$\frac{1}{2}$	"	1075.21 "
1	quart	57.75 "	1	peck	537.60 "
1	pint	28.875 "	$\frac{1}{2}$	"	268.80 "
$\frac{1}{2}$	"	14.437 "	$\frac{1}{4}$	"	134.40 "
1	gill	7.218 "	1	quart	67.20 "
1	fluid oz.	1.804 "	1	pint	33.60 "
1	dram	.225 "	$\frac{1}{2}$	"	16.80 "

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